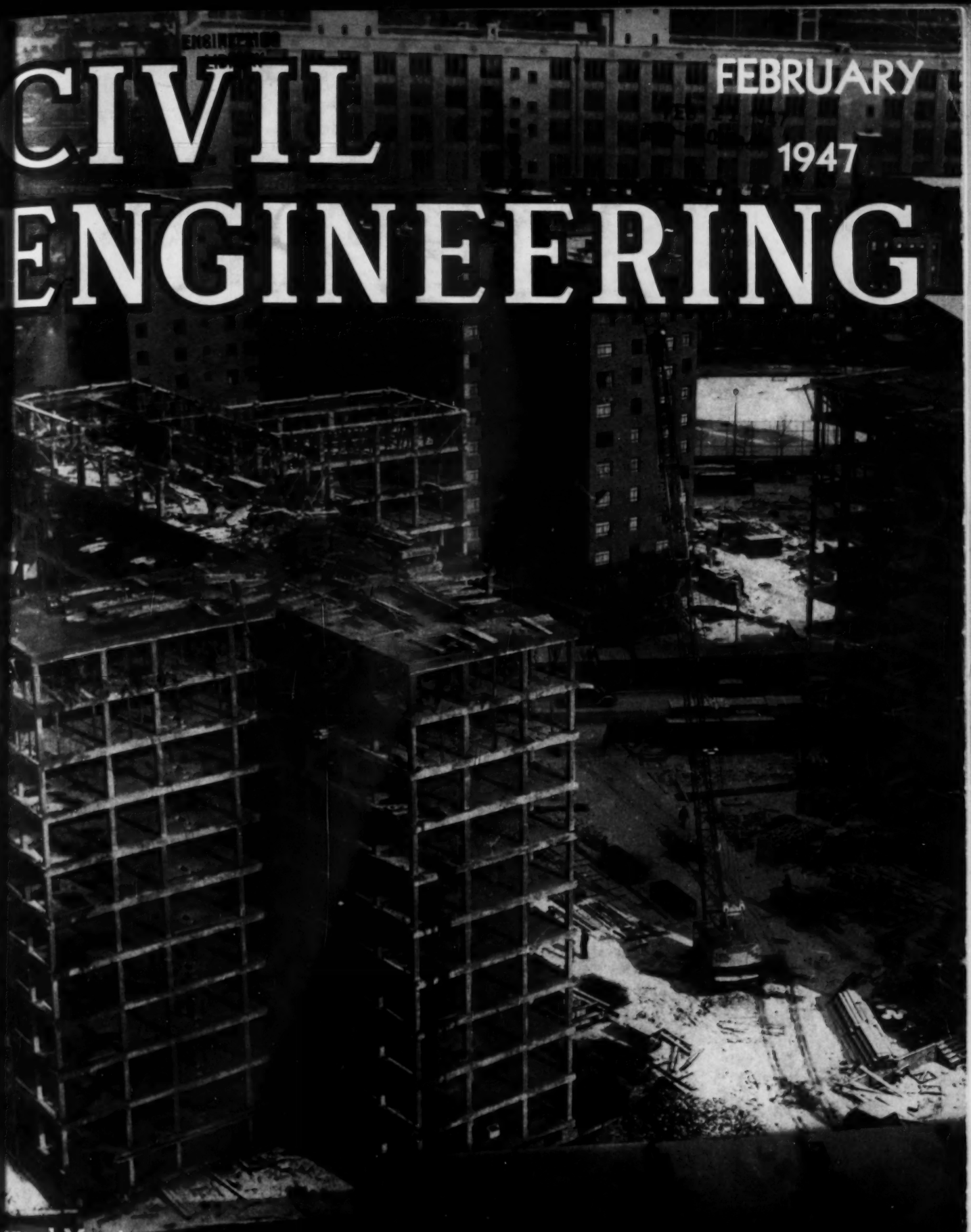
CIVIL ENGINEERING

FEBRUARY 1947



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Papers

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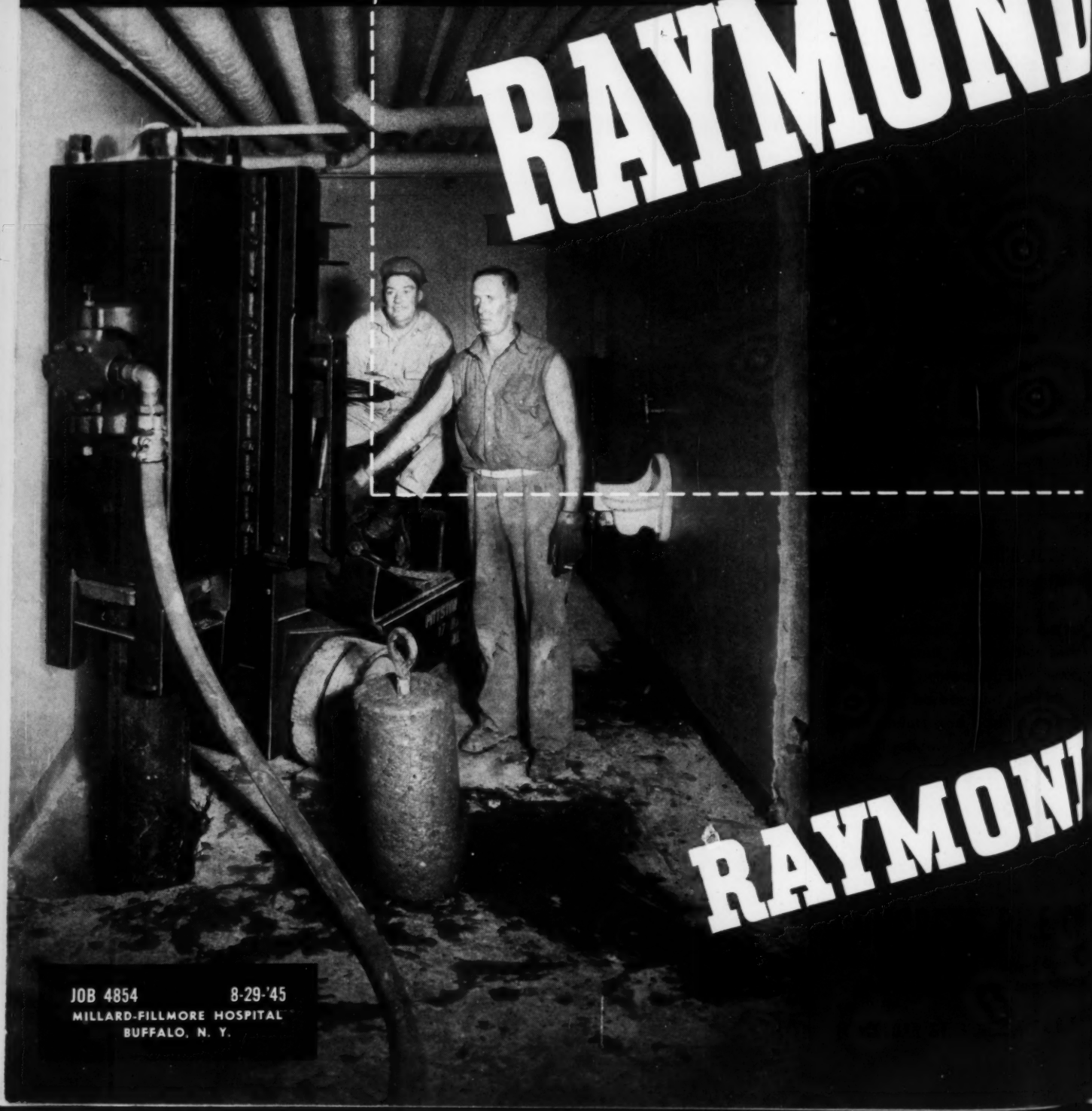

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FEBRUARY 1947
Volume 17 Number 2

CIVIL ENGINEERING

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PUBLICATION OFFICE
20th and Northampton Sts.,
Easton, Pa.
Editorial and Advertising Departments
33 West 39th St., New York 18, N.Y.

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PRINTED IN U.S.A.

Entered as second-class matter September 23, 1930, at the Post Office at Easton, Pa., under the Act of August 24, 1912, and accepted for mailing at special rate of postage provided for in Section 1102, Act of October 3, 1917, authorized on July 5, 1918.

SUBSCRIPTION RATES

Price 50 cents a copy; $5.00 a year in advance; $4.00 a year to members and to libraries; and $2.50 a year to members of Student Chapters. Canadian postage 75 cents and foreign postage $1.50 additional.

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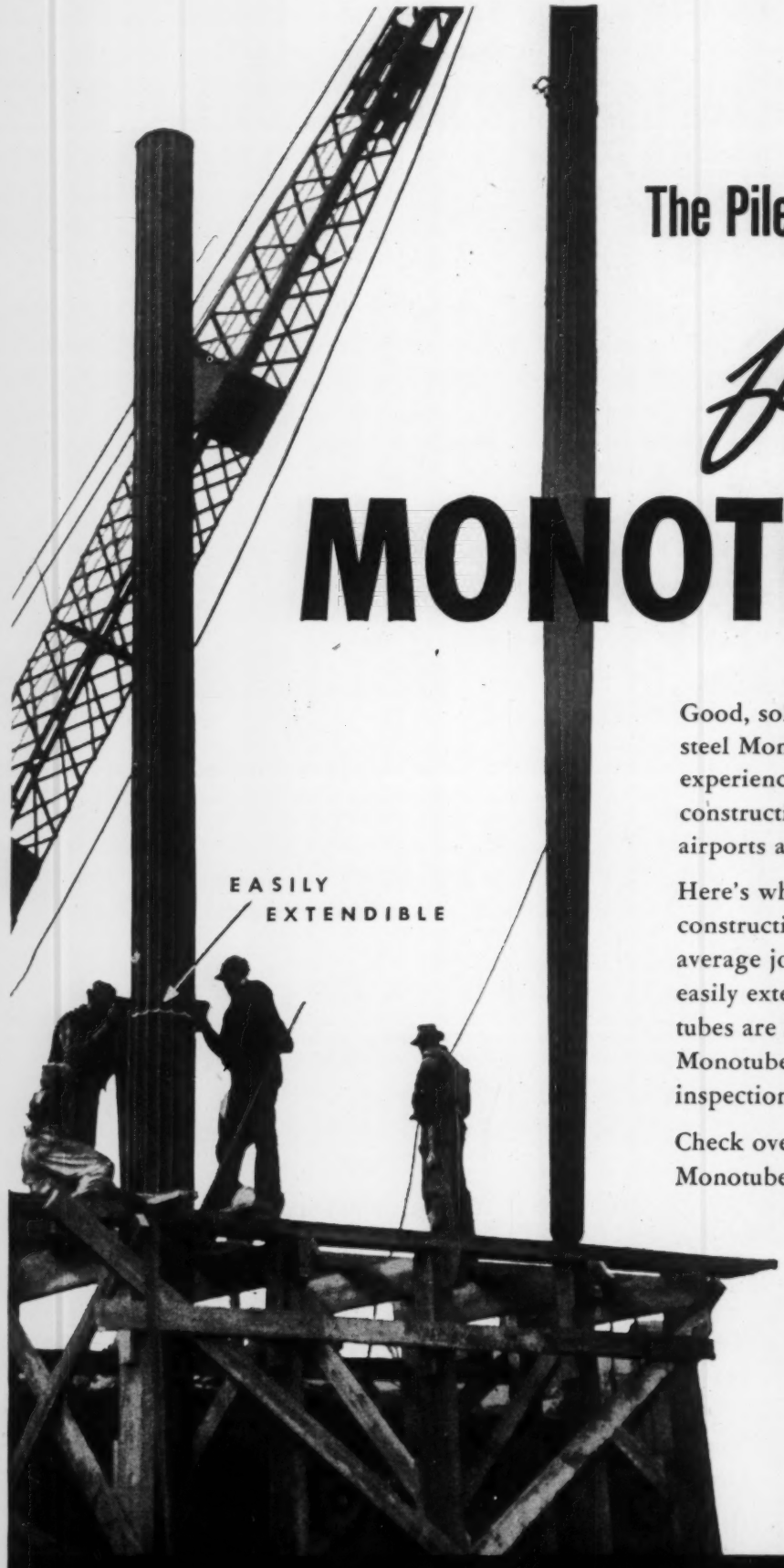

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New Methods Proposed for Solving Industrial Waste Problems

Symposium Presented Before Sanitary Engineering Division at Society's Annual Meeting

Investigations Disclose Successful Disposal Methods for Synthetic Rubber Waste

MESSRS. C. C. RUCHHOFT, O. R. PLACAK and F. E. DeMARTINI, M. ASCE

Water and Sanitation Investigations Station, Sanitary Engineering Division, U.S. Public Health Service, Cincinnati, Ohio

INTEREST IN DISPOSAL of wastes resulting from the manufacture of synthetic rubber was precipitated by the large-scale activities in this field during World War II which intensified stream pollution problems in certain geographical areas. Because of the taste- and odor-producing properties of synthetic rubber wastes, many water purification plants, particularly in the Ohio River Basin, were unable to produce palatable water from streams that received these wastes. More recently, taste and odor problems have arisen in the Detroit area which may be caused in part by a synthetic rubber manufacturing plant discharging its wastes into the St. Clair River. The difficulties encountered in this area in 1943–1944 led to laboratory studies of the problem by the U.S. Public Health Service at its Water and Sanitation Investigations Station, Cincinnati, Ohio. This paper is a condensed description of the studies conducted and the results obtained.

CRUDE SYNTHETIC RUBBER is produced in two steps: (1) Production of the raw material for polymerization, and (2) the actual polymerization operation. The principal raw materials for polymerization, in the production of butadiene polymers and copolymers, consist of butadiene, styrene, and acrylonitrile. Butadiene and styrene were the most important of the raw materials used in this country's synthetic rubber production program during the war. It can be made in a number of ways, but its production from alcohol and from petroleum fractions was adopted in the United States. Table I shows the pollutional characteristics of wastes, for a typical plant, from the manufacture of butadiene (from alcohol) and styrene, and from the copolymer plant. Odor concentration as given in this table is the reciprocal of the dilution required to make the odor just detectable.

Synthetic rubber wastes are objectionable because of their high biochemical oxygen demand values and their taste and odor-producing constituents. In a typical plant as much as a ten-fold dilution of these manufacturing wastes with condenser water gives an odor concentration in the main outfall of 460, and a population equivalent of the total plant waste of 474,000, as calculated from its B.O.D.

Removal of Tastes and Odors

Early studies at Cincinnati were directed toward removal of tastes and odors by conventional methods of water purification, or modifications thereof. Treatment processes investigated were: coagulation, ozonation, addition of activated carbon, breakpoint chlorination, and aeration by means of diffused air-bubble aeration and by spraying. Coagulation and ozonation were of little or no value. Activated carbon in large doses, 100 ppm or more, completely removed the tastes and odors.

Breakpoint chlorination gave variable results and required careful control. The best results were obtained directly at the breakpoint. In plant-scale operations this fact would impose practical difficulties. Above a certain limiting concentration of wastes, 0.5 to 0.9 percent for styrene waste, and 3.0 percent for butadiene waste, breakpoint chlorination was entirely valueless. Aeration, by diffused air, appeared to be a promising procedure, and even at ordinary temperatures usually produced some odor removal. When the solution temperature was raised to 50 deg C, aeration was a very effective method of treatment. However, even this moderate increase in temperature would be impracticable in a water treatment plant.

Pretreatment of Synthetic Rubber Waste

Observations of conventional water treatment processes indicated that a logical solution to the problem should begin with treatment of wastes before their discharge into streams, to reduce the load on water treatment plants.

Accordingly, various methods of waste treatment were investigated. Wastes from which oily material was removed were used, on the assumption that the heavy oily material found in the butadiene waste would be skimmed off and burned or otherwise disposed of. Aeration, chlorination, treatment with sulfur compounds, and biological treatment were studied. All treatments except the last were found useful only for odor removal. Complete treatment of the wastes should include reduction of organic content as well as of taste and

TABLE I. ANALYSIS OF TYPICAL WASTES FROM THE SYNTHETIC RUBBER INDUSTRY

Plant Area Involved	Approx. Daily Discharge in Million Gal	pH	Total Solids, ppm	Suspended Solids, ppm	5-Day B.O.D., ppm	Odor Concentration
(1) Butadiene waste	1.90	2.8	300	27.6	2,550	16,100
(2) Styrene waste	4.62	6.2	150	4.5	180	690
Copolymer plant						
(3) Process waste	2.34	4.3	5,580	12.3	69	62
(4) Recovery and reactor	0.39	8.0	570	23.6	492	8,760
(5) Main sewer*	2.63	7.0	6,530	46.0	168	930
(6) Main outfall, Institute*	119.4	5.4	270	15.5	81	460

* (5) Represents the mixture of (3) and (4). (6) Represents the mixture of (1), (2), and (5), plus large quantities of condenser water.

odor. The greater part of this phase of the study was therefore devoted to biological treatment, as it showed most promise of success.

Separate Biological Treatment

Experiments with activated sludge showed that butadiene and/or styrene wastes can be successfully treated by the conventional activated sludge process, to give a 90 percent B.O.D. reduction, under the following conditions only:

1. That an aeration period of about 24 hours be provided.
2. That no more than 25 percent of butadiene and/or styrene waste be fed with a good domestic sewage.
3. That the sludge solids be maintained, in the aeration mixture, preferably above 2,000 ppm.

These experiments showed definitely that the inability to treat larger percentages of these wastes successfully with activated sludge was caused by insufficient organic nitrogen, and probably phosphorous, rather than by any directly adverse effect of the wastes on the sludge. The large quantities of domestic sewage required to provide sufficient nitrogen and phosphorous would probably not be available in the vicinity of synthetic rubber manufacturing plants. This factor, together with the requirement of a 24-hour aeration period, imposes difficulties which make the separate treatment of the butadiene and styrene wastes impracticable by means of the activated sludge process.

Results of investigations with individual wastes led to the belief that if the stronger wastes could be segregated and composited, a better-balanced waste—with respect to minerals—could be obtained and this could be more easily and conveniently treated. Also, segregation of cooling waters and other innocuous liquid wastes would result in a smaller volume of waste to be treated.

The most interesting observation in this investigation was the lack of correlation between B.O.D. removal and taste and odor removal. One cannot be used as a criterion of the other except in the most general way. It is possible to remove most of the B.O.D. and still have a water processing problem, due to taste and odors, of considerable magnitude. In any complete treatment of these wastes, therefore, a method (or methods) should be devised to account for reduction of organic content and reduction of taste and odor, two effects which do not necessarily occur simultaneously in the same ratio under a given set of conditions.

Treatment of the composite waste in an experimental trickling filter, having a cross-section of 22.5 sq in. and a depth of approximately 5 ft, was also studied. The average percentage of B.O.D. removal for the sewage-waste dilution was 90 percent and for the undiluted waste, 86 percent. Odor concentration, based on the results of samples run at a 24-hour interval, was reduced from 750 to 16.

Treatment of Effluent Dilutions

Treatment of water polluted with effluent from the activated sludge process, as described above, was undertaken next. Approximately 50 to 60 ppm of activated carbon was required for removal of taste and odor from a waste dilution containing 10 percent effluent and 90 percent tapwater. Complete taste removal was also accomplished by adding 10 ppm of activated carbon at the time of coagulation, with 4.0 grains per gal of alum and 10 ppm of carbon after coagulation. This split treatment accomplished odor removal with a total carbon dose of 20 ppm as compared to 50 to 60 ppm in a single dose. Aeration, settling, and coagulation were of little practical benefit in removal of tastes and odors from the 10 percent effluent and 90 percent tapwater dilution.

Breakpoint chlorination, after coagulation of the diluted effluent with 6 grains per gal of alum and settling, required 4.0 to 4.5 ppm of chlorine for 10 percent effluent in river water, and 3.5 to 3.9 ppm of chlorine for 10 percent effluent in tapwater, coagulated with 4.0 grains per gal of alum and settled. A reduction in odor from pO 6 to pO 5 was obtained with the river water dilution in 2 hours. This was further reduced to a pO of 2 in 24 hours. In the tapwater dilution, with a lower initial odor concentration (pO = 3), the odor was reduced to 2 in 2 hours and remained at that value through 24 hours. The tastes at the breakpoint, although improved, were only fair.

The next logical step in the study of biological treatment of wastes from the manufacture of synthetic rubber would be to conduct a series of experiments on a pilot-plant scale. Plans for conducting such experiments were well under way in 1945 on a cooperative basis with the U.S. Rubber Reserve Co., but because of the termination of hostilities and subsequent reduction of the synthetic rubber production program in the United States, these plans did not materialize.

Subsurface Disposal of Inland Oil-Field Brines Conserves Fresh Water Supply

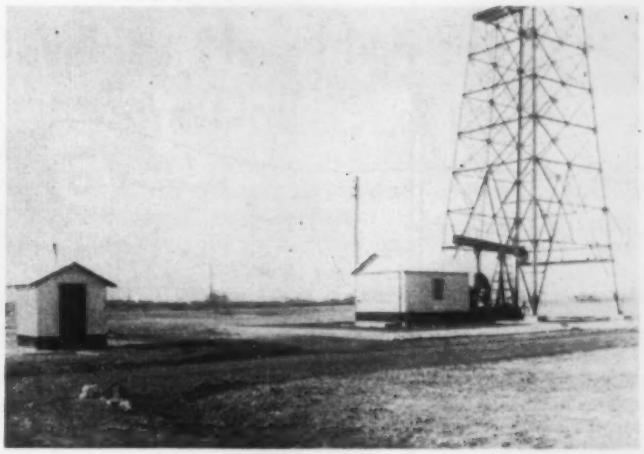
OGDEN S. JONES

Chief Geologist, Oil Field Section, Division of Sanitation, Kansas State Board of Health, Lawrence, Kans.

IT IS READILY GRANTED that oil is of paramount importance in this modern machine age, and increasingly so in time of war, as we are called upon to supply not only this nation's needs but those of our allies as well. However, it must be borne in mind that oil even in time of war should not be produced with a total disregard of other natural resources—water in particular. Farms and municipalities have a right to expect their respective watersheds to be kept free from contamination. Farms and cities have a much longer economic life expectancy than an oil field. It is therefore unjust to allow that expectancy to be jeopardized by the improper handling of oil-field brines.

SEABOARD OIL FIELDS do not face the same brine-disposal problem as do the fields located in the interior of the country. Brines produced along our coasts may be dumped into the oceans or gulf provided no oily waste is allowed to accumulate on the shores, and in particular along bathing beaches. The interior of the country has no such receiving reservoir to use for excess brines but must handle them in a manner that will not constitute a hazard to the fresh water supplies. When a highly concentrated brine or mineralized water comes into contact with a potable water the fresh water is always the loser. To keep this contact from taking place, through improper handling of oil-field brines, is the crux of the problem.

Not only are the Plains States situated in a hard-water belt, but seldom in the history of that part of the country



LANDOWNER SHOULD INSIST on adequate brine disposal before he signs a lease, to avoid conditions which ruin his land and water supply (left). Most oil companies now include costs for adequate brine disposal as a legitimate item in their lifting costs, with excellent results in good lease housekeeping (right).

have there been adequate supplies of usable surface or ground waters. The accumulative effects of industrial expansion, war plants, population increases and dry hot summers, with consequent accelerated evaporation rates, have placed a premium on water supplies. Fresh water is one of our ranking natural resources and can conceivably be the controlling factor in economic growth and industrial expansion. It is therefore increasingly evident that the protection of this vital resource from pollution should be the concern of all.

Possible Source of Magnesium

The war has made the extraction of magnesium from brines and sea water of additional importance. Sea water contains from 1,000 to 1,200 ppm of magnesium while an oil-field brine may contain several times that amount. Owing to the relatively low concentrations of magnesium in sea water, the extraction of any considerable amount of magnesium entails the handling of immense quantities of water. For that reason the exploitation of oil-field brines as a source of magnesium may be expected, providing sufficient concentrations exist in a brine that can be produced in the required volume. An oil company that is able to produce magnesium in commercial quantities might conceivably pay the disposal costs of the produced brines of an entire field.

The amount of chloride-free water in amounts necessary to reduce by dilution the highly concentrated brine to the drinking-water standard would run into large figures. For example, it would require 400 bbl of chloride-free water to dilute 1 bbl of brine of 100,000 ppm chloride content down to 250 ppm, the maximum amount for drinking water as set up by the U.S. Public Health Service. Keeping this 400 to 1 ratio in mind, consider how many barrels of fresh water would be needed to reduce 10,000 bbl of the above brine to potable water. It would mean diverting 4,000,000 bbl of fresh water, or 168,000,000 gal, a sizable amount of water.

Therefore, it can be readily understood that brine of high concentrations must be prevented from coming into contact with fresh waters. Once a potable ground water is contaminated with brine it may take years to clear the water even though the brine pollution is abated at the source.

There is a more or less popular conception that groundwater supplies are inexhaustible, which is far from being true. The dug well contacting a high water table apparently holds promise of future usefulness; however, the water table following a few seasons of subnormal rainfall may drop below the floor of such a well, returning only after several seasons of normal rainfall. A study of water reserves in most of the Mid-Continent area shows that water is exhaustible and that steps must be taken to recharge depleted aquifers. Rainfall held at the point of occurrence is beneficial, as not only are storm runoff and erosion checked, but the water has time to infiltrate into subformations, thereby augmenting the groundwater.

Contaminated water may be carried great distances from the point of origin. It may take many years for the contamination to show up in some water supply, and as many more years for it to clear up after the source of the pollution is discovered and corrected.

Brine Ponds

Following an era of uncontrolled brine discharge, the salt-water pond was put into use as a means of keeping the mineralized water out of the surface drainage. It was soon found that the use of earthen storage for liquid wastes led to early contamination of shallow ground water. In the porous soil areas of the Plains States, earthen ponds leak to an alarming extent (see Fig. 1). The leaks occur most readily at the contact between the earth fill and the original ground, or directly through the new embankment. However, the most insidious leak is downward infiltration of the impounded mineral wastes. Certain pollution quickly follows this infiltration where no impervious stratum interposes between the surface and the first fresh water. It is obvious, however, that should there be an impervious stratum the time of pollution is extended only until the water moves down dip, perhaps to the outcrop, or until a salt-water aquifer is built up above one of fresh water.

Fortunately most major oil companies and many leading independents realize that any attempt to store brines in earthen ponds is quite futile. Auger holes, drilled downstream from a salt water pond, will

WHAT IS OIL-FIELD BRINE?

We are accustomed to thinking of sea water as the "briney deep," and when the oil-drill bit goes into salt water the drillers say they have "hit the ocean." However, sea water with its 20,000 ppm of chlorides is fairly mild as compared to some of the oil-field brines with chlorides of more than six times that concentration. In total solids, sea water may average some 35,000 ppm as compared with an oil-field brine with a concentration of 248,000 ppm—or over seven times that of sea water.

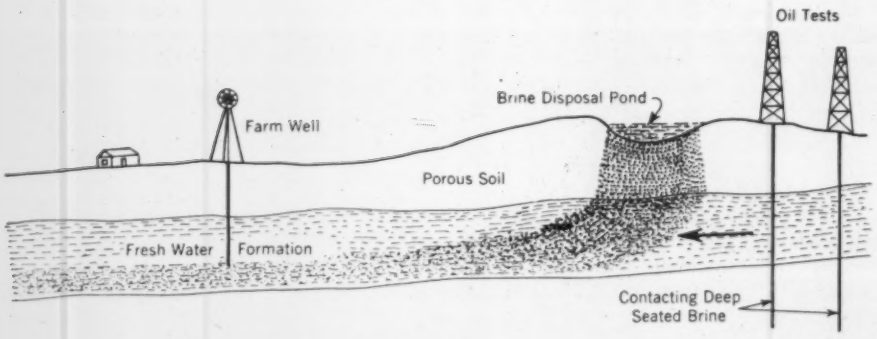


FIG. 1. POLLUTION OF FRESH WATER SUPPLIES by brine disposal ponds in porous soils is demonstrated by diagram. Stippled area indicates mineralized water infiltrating into fresh water formation, contaminating farm well down dip. Municipal supplies are subject to same source of contamination.

quickly dispel the thought that the pond is watertight.

Temptation on the part of a few heedless or unscrupulous operators to cut dikes or scour the bottoms of brine ponds makes this method of brine disposal most unsatisfactory. Before he signs a lease, the landowner should insist upon adequate brine disposal. The landowner is fairly complaisant as long as he receives royalty checks. Only after their discontinuance does he tardily think about his farm's water supply. The oil company can save much useless litigation, not to mention ruined water supplies, by making early provision for proper brine disposal. Most oil companies are now including costs for adequate brine disposal as a legitimate item in their lifting costs.

Evaporation of brines by heating has been tried in a small way, but even when evaporated through use of a cheap fuel the heavy residue of salt presents a problem of economical disposal. For instance, it takes 154,000 cu ft of 1,000 btu gas to evaporate 400 bbl of water. If this water contains 80,000 ppm chlorides, there is a residue of over 11,000 lb to dispose of at the end of each day's run, which is both expensive and burdensome.

Subsurface Brine Disposal

To expedite certain features of the work, it is desirable to enter into cooperative agreements with such agencies as the U.S. Bureau of Mines, U.S. Geological Survey, Department of Petroleum Engineering at the University of Kansas, and the State Geological Survey. With trained technical staffs these agencies have rendered a splendid service in gathering factual data to be used as an aid in the determination of the disposal policy to be followed in certain areas.

Shallow disposal—or the use of a horizon less than 1,000 ft in depth—has not under all conditions proved satisfactory. A shallow well may take considerable input water for a time, but later it may become necessary to use increasing pressure, thus adding to the disposal costs. When a deep-seated bed is known to be available, its use is less costly over a period of time. In several Kansas areas use is made of the Arbuckle (silicious lime) formation for disposal purposes. This horizon is often 4,500 ft below the surface. Fortunately it takes immense volumes of water by gravity with no injection pressures involved. A column of water 4,500 ft in depth exerts considerable pressure (approximately 2,000 lb per sq in.) on the face of the receiving formation.

Non-Corrosive Pipe Used

As most of the produced brines are highly corrosive, it is necessary to use non-corrosive pipe and tubing to insure long-time operation. Gathering lines, from the participating wells, are likewise made of a non-corrosive material.

Disposal of oil-field brines into subsurface formations, and in particular into deep-seated horizons, seems at this time to be the most logical solution to the disposal problem. Some way of building up a seal, or barrier, at the oil-water contact may be perfected which could conceivably reduce the amount of water lifted with the oil. In the future, some chemist may find a way to extract the chlorides from the brine in an economical and simple manner, but such a process has not yet been perfected for use in connection with brine disposal. Therefore, for the time being, we must be content to dispose of the brine lifted with oil in such a manner as to cause no harmful effects from inadequate disposal.

As many as 60 oil wells often discharge the produced brine into one deep disposal well. Several such disposal wells can conceivably take care of the produced brine in an entire field. If such a field is served by one disposal system, costs considerably less than one cent per barrel can be reasonably expected. Disposal of brine into deep-seated formations administered by a disposal association is the logical and economical answer to the brine disposal problem.

The Kansas law allowing the use of water as the repressuring media in the secondary recovery of oil not only gives an added impetus to the operator to increase the ultimate oil yield, but affords a legitimate use of brine for that purpose. Water flood—a recovery method practiced successfully for a considerable time in the Bradford area in Pennsylvania—has been adopted and used during the last few years in southeastern Kansas and parts of Oklahoma. Water flood consists of injecting water into a producing formation to augment the natural water drive and increase oil production.

Advantages of "Water Flood"

Use of water flood in old shallow producing areas, with brine as the flooding media in the secondary recovery of oil, has reached a stage of development which removes much of the pollutional hazard to the fresh water supply. Salt water has finally been recognized as a form of reservoir energy, and by its conservation and reuse in the producing zone, formation pressure is maintained or augmented. Successful flooding necessitates a water front moving at a uniform rate up dip in the sand body. No water flood project should be attempted without painstaking engineering to guide the actual operation. As a rule it is cheaper to use water flood as a pressure-maintenance measure than to augment subnormal pressures up to or above the original field pressure.

As time passes, oil discoveries will lag behind consumption and oil will become increasingly valuable. Economics, more than any other single factor, will do much to turn the operator to secondary recovery methods. Until justified by the economics of the oil industry, it is about as difficult to legislate against economic law as it is to advocate the use of salt water as a source of energy. Produced salt water's ultimate purpose will be to augment, or at least maintain, water drive pressures.

Salt water is a tremendous form of energy which, when brought to the surface with the oil, should not be

looked upon as a waste product but as a means, upon its re-injection, of flushing out additional oil. Fresh water plus a good soil are the nation's ranking resources. The modern oil operator respects them, as evidenced by his increasing concern as to how oil-field waters and wastes are handled.

True conservation does not mean stopping the use of any resource, but it does mean using it only as needed and without waste. Future generations can be protected in the matter of adequate water supplies if the present generation practices water conservation. Any plan devised to hold rainfall, or a part of it, at the point of occurrence should be given thought and backing. Terracing, farm ponds, many small lakes, and large dual-purpose retention reservoirs should be familiar projects in our everyday life in the future. Such a program, when and if developed on a nation-wide scale, will do much to keep the fertile top soil in place and lessen the tremendous silt load our streams are forced to carry during spring rains.

Public Must Be on the Alert

Farming and cultivating near the stream margin are not good conservation practices. Soil erosion can be materially lessened by adopting wise farming practices designed to keep the soil in place. The delta at the mouth of the Mississippi River is made up of once fertile top soil. It has been estimated that 500 years are required to produce 1 in. of soil from basic rock. Hold the soil where it will be productive and streams will be made more usable because of a lighter silt load. Streams under such names as the Big Muddy, Yellow River, and Red River are sad commentaries on excessive soil erosion.

A public well versed in water conservation will be more alert as to how water users handle this vital resource. Any industry that contaminates a water supply will be in the spotlight of adverse criticism and public disapproval. Public good will can be achieved more readily by industries that are concerned with maintaining the quality of our water supplies. If conditions do not improve, in the not too distant future we may be faced with the necessity of strict control or proration of water.

The prime controlling factor of future economic growth and industrial expansion is the maintenance of adequate water supplies as to both quantity and quality.

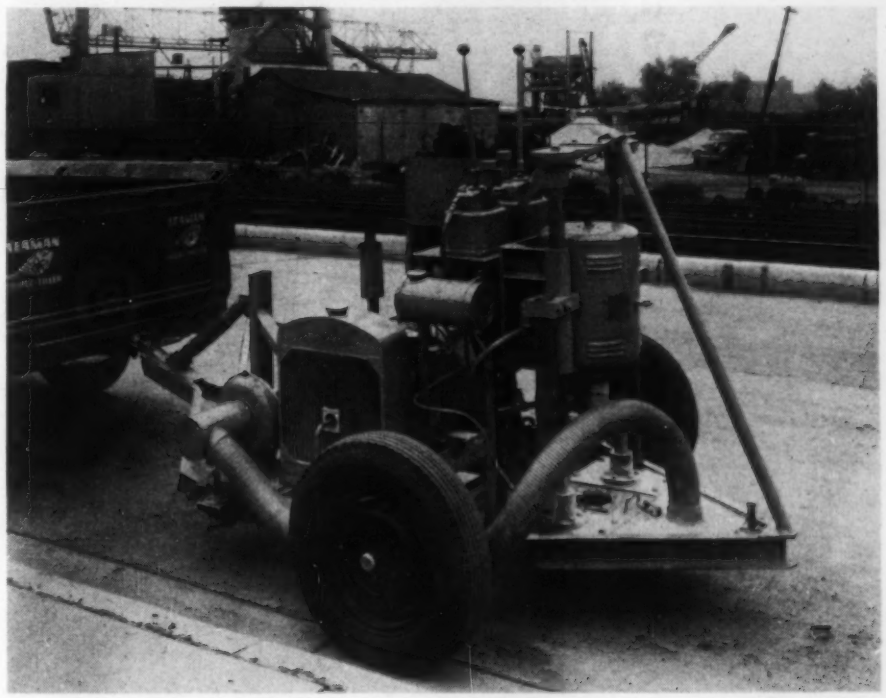
Other papers in this symposium were presented by Don E. Bloodgood, Assoc. M. ASCE, and Dr. F. W. Mohlman.

CAA Develops New High-Speed Core Drill

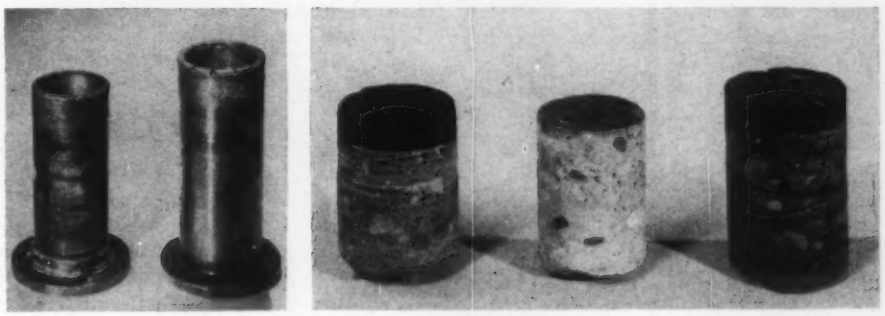
ON THE BASIS OF RESULTS obtained from a laboratory core drill built in 1945 by the Civil Aeronautics Administration, Technical Development Service, Airport Section, a contract was made with an equipment manufacturer to design and fabricate a portable, light-weight experimental unit capable of coring all types of pavement. Features of the new core drill thus developed are: air cooling of the core-drill bit and removal of the cuttings while drilling; and close regulation of rpm and rate of downward movement of the bit in materials of varied composition.

Concurrently with the construction of the coring equipment, another company made extensive investigations and tests to determine the most practical core-drill facing which would provide best cutting speed, be susceptible to cooling by air stream, and be most economical with respect to number of cores obtainable during the life of the drill. See accompanying illustration.

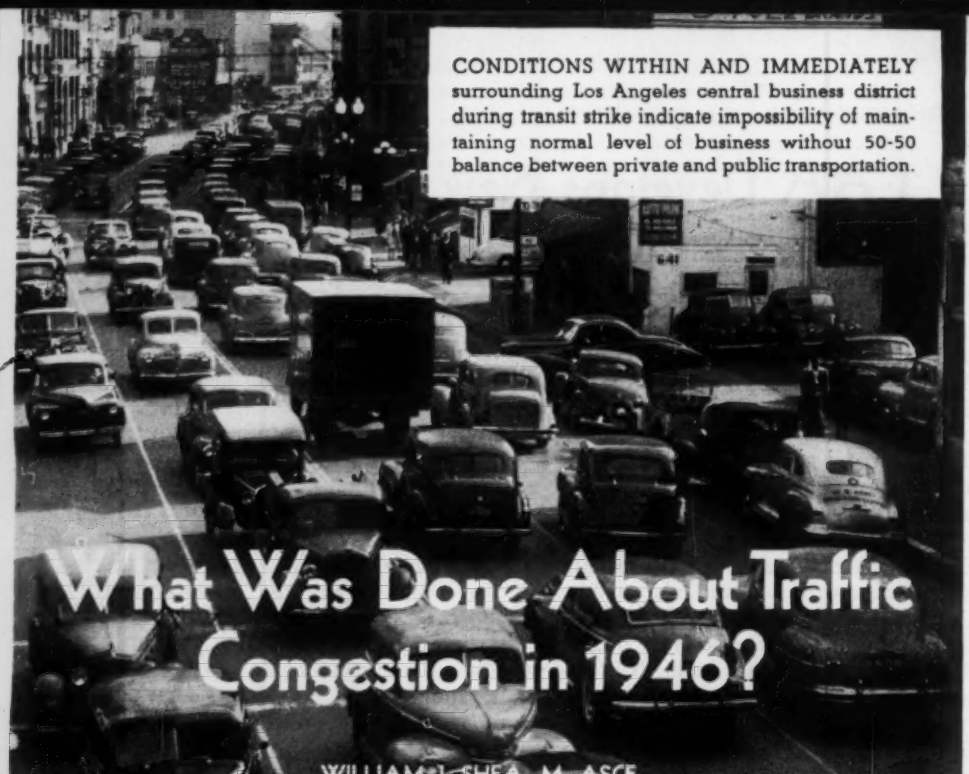
Designed to obtain test cores from any type of pavement in a minimum of time at economical cost, the machine may soon be produced commercially. Development work is handled by the Civil Aeronautics Administration, Experimental Station, Indianapolis, Ind., W. M. Aldous, acting chief, Soils, Paving, Drainage Section.—*Soil Cement News, August, 1946.*



CORE-DRILLING MACHINE DEVELOPED by Civil Aeronautics Authority is self-contained unit free from vibration and shatter even when drill operates at 1,200 to 2,000 rpm in coring concrete pavement.



MOST PROMISING TYPE OF BIT (left) for core-drilling operation is medium-size diamond embedded in metallic flux with openings for passage of compressed air. Cores (right) are taken from roads and airport runways to determine uniformity and depths of bases, strength and resistance to weather, and for comparison with laboratory design specimens.



CONDITIONS WITHIN AND IMMEDIATELY surrounding Los Angeles central business district during transit strike indicate impossibility of maintaining normal level of business without 50-50 balance between private and public transportation.

What Was Done About Traffic Congestion in 1946?

WILLIAM J. SHEA, M. ASCE
Chief of Staff, Department of City Planning, City of New York, N. Y.

A YEAR AGO the City Planning and Highway Divisions of the American Society of Civil Engineers brought together in a meeting in New York authorities who outlined what could be done to relieve traffic congestion through improved and modern: Streets and highways, off-street parking and other terminals, traffic engineering and enforcement, public transportation, and long-range city planning. A poll was taken at the close of the meeting of these Divisions, in which those present were requested to check which one of the above items would bring the maximum "decongestion" in 1946. Forty-five percent voted for traffic engineering and enforcement; twenty-five percent for public transportation. The remainder voted for expressways, off-street parking and city planning in that order.

TRAFFIC CONGESTION IS CONSIDERED the nation's No. 1 urban planning problem. What has been done about it in 1946? We all know *why* something should be done and we know *what* should be done. How much relief has your city received from traffic congestion during the past twelve months?

A recent survey conducted by the City Planning Division of ASCE, covering 23 cities in the United States and two cities in Canada with over 100,000 population, shows that the extent of relief of traffic congestion during the current year has been confined largely to traffic engineering and enforcement and improved public transportation.

Among the replies received are statements like the following:

"We have tried to do many things, but I doubt whether there has been much accomplished."

"We have been able to accomplish practically nothing in relieving congestion in 1946. A traffic survey was proposed and abandoned and a by-pass for through traffic was publicized."

"Authorities have done very little, if anything, during the past five years to make any changes in streets or highways or provide off-street parking."

"A great deal of field data has been accumulated and traffic recommendations are in the offing, but meanwhile the situation has grown worse."

"Very little has been done in our city to relieve traffic congestion. Parking meters were installed."

"We are happy to report that at long last the city has appropriated $2,000 for the traffic survey."

"Staggered hours have been abandoned, resulting in a high evening travel peak. And there is considerable laxity in police enforcements."

"A one-way loop system was established in our central business district. Transit lines were re-routed to fit the one-way program and bus stops were changed to the far side except where right-hand turns were involved. Enforcement was stepped up. As the result, traffic was speeded up. Then the Police Department withdrew its enforcement, and traffic bogged down. All of which goes to show that engineering without enforcement will not do the job. The city is also reluctant to prohibit curb parking even though the merchants are in favor of it, because the city is loath to give up the revenue now derived from the parking meters."

All cities are actively studying their traffic problems. A great deal of basic information was assembled during 1946. Many fine recommendations have been made but performance has been lacking.

What Can Be Done?

The question confronting most public officials and business men is—what can be done to implement tried and proved measures for relieving traffic congestion? The outlook is not as pessimistic as it at first appears.

In Kansas City, Mo., and Toronto, street and roadway widenings have improved ingress and egress to the central business district. In Milwaukee, Gimbel Brothers have built a 300-car capacity, three-floor open-deck garage. In Jacksonville, Fla., and Toronto, Canada, downtown bus stations have been erected for off-street loading and unloading of certain bus lines.

Transit companies and city governments in Atlanta, Baltimore, Chicago, Cleveland, Grand Rapids, Harrisburg, Hartford, Louisville, Richmond, and St. Louis have established perimeter parking lots and provided frequent shuttle bus service into and within the central business areas.

Considering that in 1946 urban travel was at a high level—with public transportation carrying nearly 24 billion rides, with more trucks,

buses and private automobiles on city streets than in 1945, and with traffic accidents below the 1945 level—traffic palliatives in the nature of traffic engineering and enforcement measures and improvements in public transit changed an otherwise black outlook for 1946 into a more hopeful situation.

Chief among the palliatives applied were:

1. Prohibition of curb parking and continuous police enforcement.
2. One-way street movement.
3. Reduction of left-turning movement.
4. Re-routing of transit vehicles, and spreading of the loading zones in the downtown area.
5. Off-peak curb loading and unloading for trucks.
6. Installation and retiming of traffic signals.

Outstanding in the use of the above measures during 1946 are the following cities:

Philadelphia. On January 2, 1946, curb parking was banned on nearly all downtown one-way streets. Loading and unloading of commercial vehicles was banned in the morning and afternoon rush periods on two major downtown streets. Time parking limits were cut to 30 minutes in the central area. Traffic movement was reversed in the morning and afternoon on certain one-way streets.

Los Angeles. During 1946, parking was prohibited in the central business district during the hours of 7 a.m. to 6 p.m. Parking was also prohibited between 7 a.m. and 9 a.m. and 4 p.m. and 6 p.m. on certain main arteries leading out of the central business district. Increased enforcement was applied against overtime parking. Off-center traffic lanes were installed on the main arteries leading out of the central area. One-way traffic was established in the Third Street Tunnel. Installation of additional signals and retiming to speed up traffic were effected. Prohibition of left-hand turns at important intersections was universally applied. Loading and unloading of merchandise during the morning and afternoon rush hours were eliminated.

Dallas. Parking was eliminated on four major downtown streets between 4:30 and 6 p.m. and traffic was speeded up 26 percent. Several short outlet streets from the business district have been made one-way. Left-hand turns for automobiles have been eliminated at

OFF-STREET PARKING provided by suburban neighborhood shopping center (above) and parking garage (below), Washington, D.C., help solve No. 1 urban planning problem—traffic congestion.

PROHIBITION OF CURB PARKING and continuous police enforcement are among chief traffic congestion palliatives used by New York City in 1946. Conditions on Manhattan's West 38th Street before enforcement of no-parking measures are pictured here.

several busy corners. Truck routes have been established by-passing the downtown business district, thus keeping those trucks that do not have deliveries or pickups in the central area outside of its congested streets.

Portland, Ore. Parking has been restricted on streets leading to and from bridges serving the downtown area. Extra police have been stationed at key intersections during the rush hours. Several streets have been made one-way. New traffic lights have been installed at 18 intersections with pedestrians' "walk" and "wait" indicators. Larger bus-loading zones have been established and loaders have been placed at the heavy loading points by the transit companies to expedite the movement of transit vehicles. Transit vehicles have been rerouted on entering the busi district so as to avoid the h y congested streets and to reduc a minimum the left turn, and to make a one-way movement in the business district for transit vehicles.

Excellent application of palliative measures has also been made in Jacksonville, Fla., South Bend, Ind., Youngstown, Ohio, New Orleans, La., and Buffalo, N.Y.

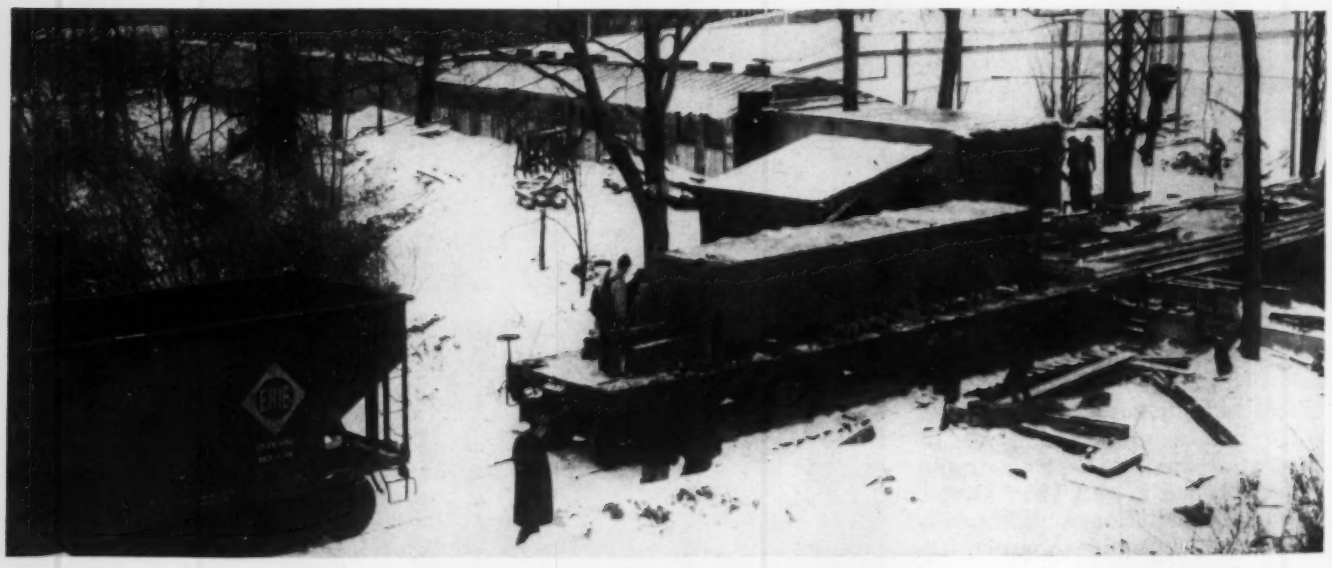
All cities have tried traffic palliatives in one way or another and have found them satisfactory. The main problem now is to find ways and means to implement more of these palliatives and to coordinate the thinking of public officials charged with traffic and planning improvements so that plans for garages and terminals and expressways for private cars, trucks and transit vehicles can be constructed.

There is no panacea for traffic congestion. What is needed in every city is a comprehensive and integrated program of street and expressway improvements, additional off-street parking, truck and bus terminals, improved public transportation, modernized traffic engineering measures, selected and continuous police enforcement, and a public educated to the evils and waste resulting from the inefficient circulation of people and goods. The latter is one of the most important of the factors involved in the overall solution of the congestion problem.

A revaluation of the respective rights of public property, that is, streets and highways for the accommodation of moving traffic, and private property, that is, property abutting on streets and highways and in which traffic is generated, is an essential element of the problem since restrictions on the bulk of buildings and the coverage of property will have to be imposed and the design and utilization of structures correspondingly affected. In consequence, any long-range program for effective relief from congestion must be thoroughly understood by property owners and the public generally, and merit their active support if efforts successfully to solve the problem are to result in other than wishful thinking.

This paper was presented before the City Planning Division at the New York Annual Meeting.

Heavy Steel Forgings Hauled by Rail



KNOWN AS THE "Cyclotron & Southern Railroad", a 473-ft special "branch line" was laid by The Erie Railroad to haul ten forgings, such as the 157-ton giant shown above, directly to the emplacement site on the University of Rochester campus, where a new 1,200-ton super atom-smasher will be assembled. The project is sponsored by the U. S. Navy Office of Research and Invention.

The largest forging load handled is equivalent to roughly three times the average heavy car loading. Heavy-duty, 16-wheel flatcars are required for this hauling job and special precautions must be observed in transit. The cars bearing the forgings are located at least four car-lengths distant from the locomotive, to prevent excessive loading of bridges and roadbed. Empty cars weighing under 100,000 lb each are required at either side of the special flatcars to act as buffers.

When the forgings are set in place, the cyclotron magnet will be 26 ft long, 11 ft thick, and 17 ft high. Magnet pole pieces will be 130 in. in diameter. High dirt embankments extending above the ravine in which the cyclotron is located will serve as a radiation shield.

The concrete piers that will support the magnet are 8 ft thick and are themselves supported on concrete piling. Special hoisting rigging with 50-ft-high gin-poles was used in lifting the massive forgings from the railroad to the concrete emplacement.

Bridge Clearances Concern Navigation, Federal Government, Railroads, and Highways

Symposium Presented Before Engineering Economics Division at Society's Annual Meeting

INTRODUCTION

THE PROBLEMS INVOLVED in the crossing of a water traffic route by a land traffic route are preeminently those of engineering economics. Water transportation and land transportation are both vital to the welfare and prosperity of this country, and neither should be unduly restricted in its efforts to render efficient public service.

Congress, through the power granted to it by the Constitution to regulate commerce between the states and with foreign countries, has passed certain laws for the control of bridges over navigable waterways and has placed upon the shoulders of the Secretary of War the duty of administering these laws. He, in turn, has delegated this task to the Chief of Engineers of the Army. This task is no sinecure. An umpire in a ball game, no matter how able and conscientious he may be, is pretty apt to be disliked by one or both sides.

Navigation interests have maintained that railroads have been given unfair advantages and allowed to unduly obstruct the waterways. Railroads and highway interests, on the other hand, have claimed that in many instances they have been forced to construct drawbridges or excessively high fixed bridges in deference to the needs of navigation, which they claim are inconsequential or visionary. The Chief of Engineers must carefully weigh these conflicting arguments. He must, at the same time, give careful consideration to the future trends in water traffic and land traffic and endeavor to predict the probable effect of any proposed bridge construction on the economic development of the tributary area. It probably was due to the complaints of some dissatisfied parties such as have been mentioned above, that the Society, some years ago, appointed a Joint Committee on Waterway Clearances, composed of three representatives from each of the following Divisions: Engineering Economics, Structural, and Waterways.

The papers in this symposium are not to be considered as the reports of subcommittees but as individual expressions of the authors, of how the problem is viewed by each of the interests co[illegible]ed, and a statement by the Chief [illegible] Engineers regarding the governme[illegible]s interpretation of the problem and the methods adopted to assure an equitable administration of the law, having in view the best economic interests of the country both present and future.

CHARLES T. LEEDS, *Chairman*
Joint Committee on Waterway Clearances

Government Shares Expense of Removing Obstructions to Shipping on Navigable Streams

L. C. SABIN, HON. M. ASCE
Vice-President, Lake Carriers' Association, Cleveland, Ohio

FROM A HISTORY of bridge construction in the United States, it is clear that in building bridges over navigable waters the needs of land traffic as well as those of navigation have received consideration. Because of the possible military value of canals for navigation, their construction was placed under the War Department at an early date; and the Engineer branch of the Army, because of the technical knowledge of its officers, was given the duty of making the necessary surveys and estimates for construction. Thus, when the regulations relating to bridges over canals and navigable streams were adopted, it was natural that the administration should be lodged with the Secretary of War and the Chief of Engineers.

IMPORTANT CHANGES REGARDING RAILROAD BRIDGES are contained in the law approved June 21, 1940, known as the Truman-Hobbs Act. This law introduces a new concept in that it recognizes the obligation of the United States to share in the cost of alteration of a railroad bridge found to be unreasonably obstructive to navigation. It provides for the submission of plans and specifications to the Secretary of War for approval. A somewhat involved formula is outlined in the law to apportion the cost between the United States and the bridge owner according to the respective benefits to each.

Thus far the application of this recent act has been quite limited, but by its terms the railroads are very materially relieved from the burden of expense connected with the alteration or replacement of old and obstructive bridges. In one case involving the renewal of six bridges, the tentative adjustment allocates 82 percent of the estimated cost to the United States. It will be noted that the act does not apply to bridges not carrying railroad traffic.

The latest action of the Congress relating to bridge construction is found in Title V, "General Bridge Act of 1946," which is a part of the "Legislative Reorganization Code" approved August 2, 1946. This grants the consent of Congress to the construction and operation of bridges and approaches which have been approved by the Chief of Engineers and the Secretary of War. This relieves the Congress of approving

GREATER CLEARANCES ARE PROVIDED for Cape Cod Canal navigation by Buzzards Bay Railway Bridge completed in 1935. Structure, which replaces inadequate lift span in background, has span of 544 ft between bearings, and maximum vertical clearance of 135 ft.

individual bridges. It makes special requirements regarding privately owned highway toll bridges, which must be approved by state highway departments or by the Public Roads administration.

Railroads Question Preferential Treatment

Some railroad officials are inclined to resent what they consider preferential treatment of navigation in the improvement of channels and the regulation of bridge construction by the Government. The theory is sometimes advanced that the United States is furnishing and protecting the navigation ways for ships while the railroads must furnish, improve and maintain their own rights-of-way.

This argument fails to consider the basic difference between the two in that the shipway is open to any citizen, whereas the rail right-of-way is private and can be used only by its owner. Thus, the ship channels more nearly resemble roadways for highway traffic, which are improved and maintained by governmental agencies, either federal, state or local. It would be quite impracticable to finance the improvement of either ship channels or highways through assessment on prospective users.

The carriage of certain classes of freight, particularly bulk commodities, is very much cheaper by ship than by rail, and the resulting savings are so widely distributed that the use of public funds for improvement and maintenance appears justified. For instance, in the transport of iron ore, coal, grain, stone, and petroleum on the Great Lakes the savings over probable rail rates return to the public in an average year more than the entire cost of the improvements made. There doubtless are river and harbor improvement projects that do not return the carrying and maintenance charges but in some cases the original costs may have been returned through the development of the country and should be charged off.

It is for these reasons that vessel interests feel warranted in urging the improvement and protection of natural waterways, including regulation of bridge construction and operation.

Bridge Clearances

A review of the prevailing clearances of existing bridges on some of the more important rivers will be helpful in disclosing the result of the regulations heretofore applied in passing on construction permits.

On important coastal rivers the horizontal clearance of movable bridges is quite restricted for some of the older structures, but a vertical clearance of not less than 135 ft is provided by fixed or suspension bridges over such important channels as the East River in New York, the Delaware below Trenton, and the Potomac below Washington.

Bridges below Portland, Ore., over the Columbia and Lower Willamette Rivers on the Pacific Coast have a minimum horizontal clearance of 200 ft, while the minimum vertical clearance is 144 ft in a vertical-lift span.

Over the Mississippi River, a swing span of 110-ft width exists at Davenport, Iowa (built in 1896), but below this point there is a channel width of at least 153 ft, and below St. Louis for 1,200 miles the minimum width is 500 ft.

On the Missouri River a swing span at Kansas City, authorized in 1915, has a clear width of 200 ft, while one at Jefferson City, authorized in 1896, has a span of 205 ft. Aside from these two old bridges, the 400-mile reach below Kansas City has 19 bridges with a minimum horizontal clearance of 328 ft. In the 980-mile length of the Ohio the minimum span is 320 ft, and on the Monongahela the minimum is 250 ft.

Referring to vertical clearances, the bridges over the Mississippi below St. Paul provide a minimum height of 63 ft above pool level and 42 ft over high water. On the Missouri below Kansas City the heights are 66 ft above low water and 52 ft above high stage.

The Ohio bridges provide a clearance of at least 90 ft above low water and generally about 68 ft above the normal pool level. On the Monongahela there are three bridges having a vertical clearance of less than 44 ft above pool-full stage and three having less than 30 ft above maximum navigable stage.

The commerce of these larger inland rivers in 1944, as given in the Annual Report of the Chief of Engineers, is approximately 44, 31 and 38 million tons of freight for the Mississippi, Ohio and Monongahela respectively, with a total ton mileage of 18.6 billion.

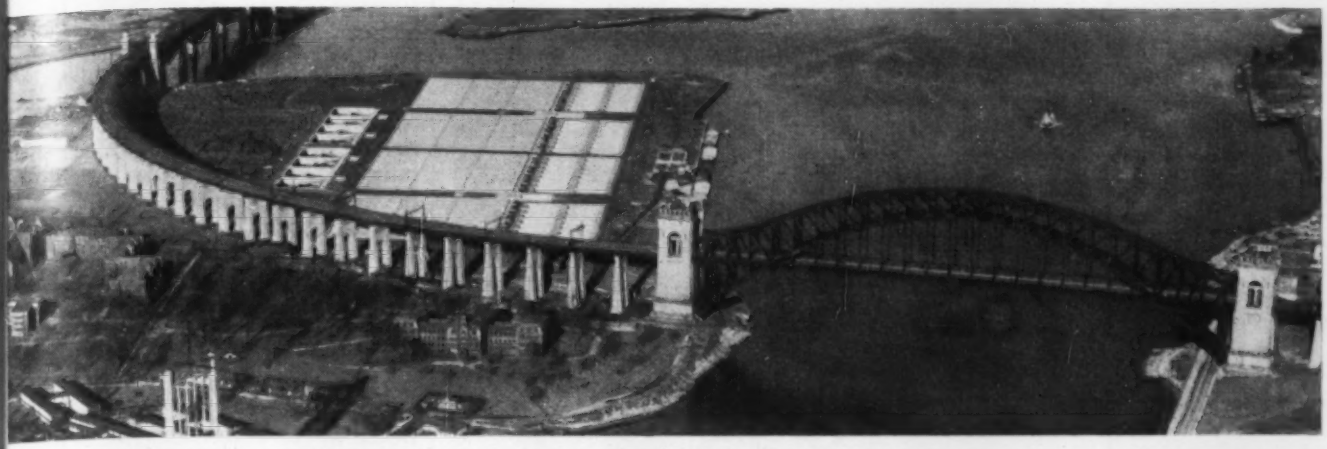
Traffic Determines Bridge Dimensions

Consideration of these clearances for bridges over the more important waterways indicates that the policy is to standardize dimensions to fit the character of the vessel traffic.

On coastal rivers, intended to accommodate ocean-going ships, and in the inner harbors on the Great Lakes, there are many bridges having insufficient horizontal clearances. On inland rivers the horizontal clearances should be governed by the width of a barge tow and the difficulty of maneuvering in a current, and there appears to be an endeavor to establish a minimum of not less than 200 ft.

On the more important rivers on the coast, a height of 135 ft seems to have been adopted as the desirable vertical clearance. On the through channels of the Great Lakes a vertical clearance of 150 ft has been required, although this may be greater than needed, especially as the 20 lift bridges over the Welland Canal have a rise limited to 120 ft.

On the principal streams of the Mississippi system the clearance should be regulated by the dimensions of the towing vessels. Below St. Paul on the Mississippi a clearance of at least 60 ft above pool level seems to be the aim. On the Ohio a height of 90 ft above low water is understood to be the present requirement, while



VERTICAL CLEARANCE of not less than 135 ft is provided by fixed or suspension bridges over East River in New York, Delaware River below Trenton, and Potomac River below Washington, D.C. Pictured here is Hell Gate Bridge on New York Connecting Railroad, over East River, New York, N.Y.

47 ft above pool elevation is required for such rivers as the Monongahela, Kanawha and Allegheny.

Some of the older bridges with low clearances may limit the height of spars and upper works until they can be altered to conform to the present standards of towboat design.

There would appear to be no other logical way of regulating clearances than by this relation to the type of carrier in use. Methods of water transportation have developed generally in the direction of larger carriers, to an extent that was not foreseen. As a result some of the older structures have become unduly obstructive to the free passage of commerce in the most economical type of carrier. The alteration of these structures must be approached with due regard for the volume of traffic and the cost of alterations. Now that the law requires a division of costs between the railway bridge owner and the U.S. Government, it is expected that the owners of railroad bridges will see some advantage in making the alterations needed to facilitate navigation.

War Department Determines Bridge Clearances Required for Public Navigation

R. A. WHEELER
Lieutenant General, Chief of Engineers, U.S. Army, Washington, D.C.

FEDERAL LAWS GOVERNING the construction of bridges across navigable waters of the United States make it unlawful to construct or begin the construction of a bridge across any navigable water unless the plans shall have been submitted to, and approved by, the Chief of Engineers and the Secretary of War. It is the duty of the War Department to require such clearances, and to impose such reasonable conditions, as it may deem necessary in the interest of public navigation. In performing this duty considerably more than mere measurement is required.

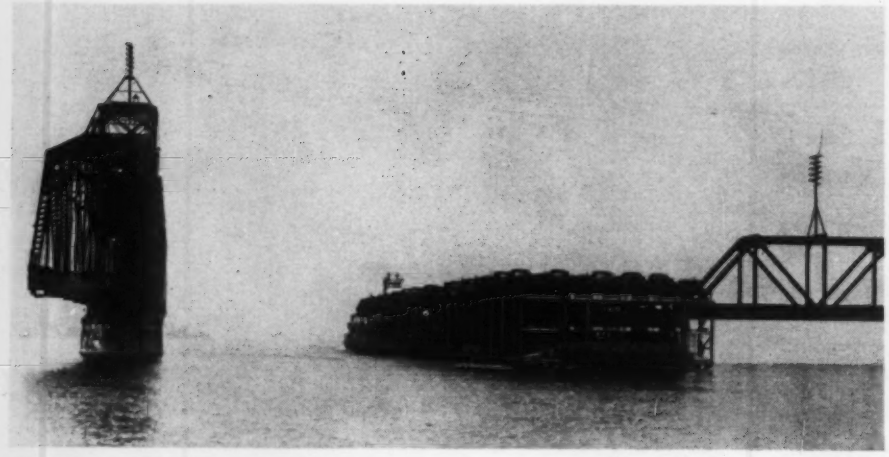
The powers of a prophet and the judgment of a Solomon, neither of which we pretend to have, would be of help. But we can, and do, gather all available facts, ask for the views of and listen to the interests affected, and render impartial judgment to the best of our ability. We are acutely conscious of the fact that the injury, if there be one, to water or land interests, is as permanent as the work we authorize or require. Whatever injury may be created will become greater in proportion to the increase of traffic and the development of the region.

In general, the policy formulated by the Corps of Engineers can be separated into two phases: First, the establishment of so-called "standard bridge clearances" for particular waterways, and second, examination and study of each particular bridge in the light of modern conditions.

Boards Study Clearances

From time to time, boards have been created by the chief of engineers to study and recommend standard clearances for a waterway, or a

HEIGHT, SIZE AND NUMBER of vessels using waterway, location of bridge site in relation to sailing courses, and depth and width of channel are factors considered in granting permission to construct bridges over navigable channels. Vertical clearance of San Francisco–Oakland Bay twin suspension bridges ranges from 180 to 214 ft. Main-span lengths are 2,310 ft and side spans 1,160 ft.



STANDARD BRIDGE CLEARANCES are established by Corps of Engineers for particular waterway or group of related waterways, and each bridge is studied in light of modern conditions. Pictured here is Southern Railway Bridge on Tennessee River at Decatur, Ala. Tugboat with loaded barge is passing through open swing span.

group of related waterways. The procedure in each case has been the same—a public hearing to afford all interested parties an opportunity to be heard, the collection of all available data, and a consideration of prospective development of the region. The purpose of the clearances thus established is to furnish a guide to the problable necessary clearances in order to avoid unnecessary waste of time, effort and money on plans that could not possibly be approved.

The clearances are clearly understood by all concerned to be neither a threat nor a promise of what finally will be found necessary after detailed examination of a particular application. One of the earliest uses of boards for this purpose was in 1894, when two reports were made concerning a bridge across the Hudson River in the port of New York. Much opposition had arisen against the location of any pier in the river, and it had been argued that a single span across the river was not feasible. To quote O. H. Ammann, M. ASCE, "the reports of both these boards, which have become classic documents, furnished valuable and exhaustive information, and definitely disposed of the question of feasibility of a single span across the Hudson River in New York and the adaptability and economy of the suspension type for long spans."

The latest board study is now in progress on the Gulf Intracoastal Waterway. The writer has been informed that the highway departments of the states involved have prepared a very careful and thorough brief concerning the economics of waterway crossings, and it is anticipated that considerable valuable information on the current subject will be developed. Emphasizing once again that established standard bridge clearances are a guide and not a decree, they are directed not only to bridge owners as standards of bridge construction, but also to navigation interests for standardization of their equipment.

An ideal bridge from the standpoint of navigation is one that is not obstructive in any form—it is one that has unlimited vertical clearance and for horizontal clearance has its piers entirely outside of the waterway. Unfortunately, costs of such an ideal structure are usually prohibitive and hence compromises must be made.

Public Hearings Held

The procedure of the Department in acting upon individual applications for approval of plans for a proposed bridge is, in general, well understood. A public notice of the pending application to all interested parties is mandatory. If the waterway is important, or if opposition develops, a public hearing is held. Frequently a conference of opposing interests is held by the District Engineer, and a mutually agreeable compromise is worked out. The District Engineer forwards his report and recommendation to the Division Engineer, who reviews the case and forwards it to the Chief of Engineers. Before final action by the Secretary of War, the case may be referred to other interested government agencies, particularly the Navy Department, for an expression of their views.

In considering an application, a study is made of the height, size, and number of vessels using the waterway; the location of the bridge site in relation to sailing courses and to bends in the waterway; and the depth and width of the channel. Comparisons are made with bridges at other locations where conditions are comparable and a check is made on the clearances of other bridges that must be passed by navigation expected to operate at the site of the proposed bridge. Records of commercial statistics are studied, and consideration is given to the commercial, industrial, and physical development along the waterway and the territory it serves. These studies are to determine whether the clearances of existing bridges are adequate to care for such increases in navigation as statistics indicate may occur during the normal life of the bridge. This is especially important where a project for improvement of the waterway has been, or is expected to be, adopted.

National Defense Considered

The relation of the bridge to national defense is studied, considering both its use for transporting war materials, men, and equipment, and its effect on the use of the waterway in the event it should be destroyed by accident or design.

The effect of the bridge on the regimen of the waterway is studied. Will the piers and approaches constrict the channel? Will they cause silting and a corresponding increase in channel maintenance costs? Where a conflict of interests is sharply drawn, the applicant will frequently be asked for an estimate of the added first cost and the maintenance and operation cost to provide an increased clearance.

The pending case on the proposed bridge across the Delaware River below Wilmington, although not typical as to importance, is typical as to procedure. The applicant submitted plans for a suspension bridge with a horizontal clearance of 2,000 ft normal to the channel, and a vertical clearance of 175 ft over the channel. The board considering the application has had requests for horizontal clearances up to 4,000 ft and vertical clearances up to 200 ft. The board is engaged not only in estimating the added cost of increased width and height, but also in considering the effect of such added cost on the amortization of the bridge within the 30-year period allowed by the Act of Congress authorizing the bridge.

The War Department is, of course, not infallible. Unquestionably certain bridges may be pointed to with some justification as having excessive clearance for the commerce that has actually developed. On the other hand, the fact that the Secretary of

War has found it necessary to order alteration of bridges as unreasonable obstructions on the average of one every year, indicates an error of judgment in the opposite direction. And in the case of railroad bridges, such alterations cost the United States 80 to 90 percent of the cost of alteration. We have been criticized as arbitrary where identical clearances are required for all bridges on a waterway; and we have been criticized as inconsistent where various clearances are required on a waterway.

We must meet all reasonable needs of navigation, but we must weigh all conflicting interests, and we must have respect for the cost of things. I would like to think that this entire subject is merely one of economics, with engineering considerations as prime factors. Unfortunately, perhaps, this is not the case. It is a matter of fundamental law that the navigation of a stream is not a matter of economics but of public right.

Recent Legislation Alleviates Railways' Economic Burden

J. B. AKERS, M. ASCE
Chief Engineer, Southern Railway System, Washington, D.C.

WATERWAY CLEARANCE REQUIREMENTS which cause a railway company to provide a greater distance between piers, to raise its grade line, or to use a movable bridge in lieu of a fixed bridge, result in a greater cost to the railway company than would ordinarily be incurred in spanning the waterway. As the requirements for horizontal and/or vertical clearances are increased, the additional expense to the railway company is likewise increased, in greater than direct proportion. The trend is toward greater clearances on waterways under development by the Corps of Engineers, with a consequent greater burden on railways crossing or seeking to cross those waterways.

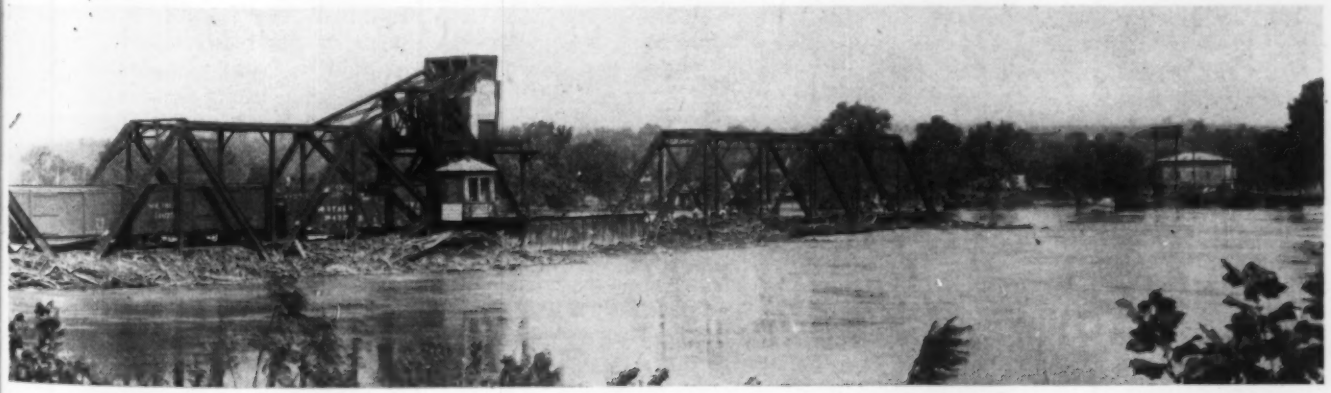
At the present time movable bridges over navigable streams of the United States provide a great variety of horizontal clearances ranging from less than 40 to over 300 ft. Horizontal clearances of fixed spans vary to an even greater extent. There is a similar variation in vertical clearances, but of course within a more narrow range, except for movable bridges providing unlimited vertical clearances. The great majority of the bridges provide only small clearances, those of larger clearances being generally confined to the major waterways being developed by the Corps of Engineers of the U.S. Army.

> IN MOST CASES clearance requirements for waterway traffic impose a burden on the railway seeking to cross the waterway. The only exception to this general statement is a case in which the grade and span arrangement most desirable to the railroad provides sufficient clearance for waterway traffic without special provision therefor.

Excessive Costs May Force Abandonment

In the past, railroads have been forced into abandoning lines because of the expense involved in meeting the clearance requirements for waterway traffic. For example, the Southern Railway formerly crossed the Tombigbee River near McDowell, Ala., on its line from Marion Junction to York, Ala. In December 1932, the draw span was knocked off of the pivot span into the river by a boat operated by the Inland Waterways Corporation. The railway finally won a moderate judgment for the destroyed span. If the bridge were replaced, the Corps of Engineers would require a structure with a 200-ft horizontal clearance rather than the 110-ft clearance of the destroyed span, at a cost of about $350,000 or more. This great cost forced the railway to abandon its river crossing, and it now operates the two ends of the line separately, with no connection between them. In this case, if the York to Marion Junction line had been a separate and independent railroad, and local interests had been successful in compelling the rebuilding of the bridge, the probable result would have been complete abandonment of the line, as its business was not sufficient to enable it to pay such a sum for bridge reconstruction and to continue operation.

Since the Truman-Hobbs Act became law, the burden on railways has been lessened. No longer is it possible for the government, acting through the Corps of Engineers, to require a railway to rebuild an existing bridge to provide the benefits of



REQUIRED TO OPEN BUT ONCE for navigation since its installation in 1911, 101-ft Scherzer rolling lift span, on Southern Railway Bridge over Savannah River at Augusta, Ga., is shown here in damaging flood of 1929.

greater clearances for waterway traffic at the sole expense of the railway company. However, this Act does not relieve the railroads of all costs incident to remodeling such bridges. A major relief has been provided, but the railroads still must bear certain expenses incident to the requirements of navigation, such as increased cost of maintenance occasioned by the more expensive types of bridges required, and the Act provides no relief whatever to a railway that is seeking to cross a waterway with a new line.

There have been cases where excessive overhead clearance was demanded for the passage of small craft; and draw spans were installed in highway and railroad bridges. Fixed spans are often feasible and show large savings in cost of construction as well as in cost of operation. For small craft, telescopic masts and hinged smokestacks can often be used with great overall economy. The decision may hinge on the relative importance of the waterway as compared with the highway or railroad, as well as on the cost of construction and maintenance.

Standardization of Clearance Not Feasible

Consideration of the high cost of providing bridges with large openings for the needs of waterway navigation, and the great variety of sizes of openings now required and in use on the various waterways of the United States, particularly since the great majority of these openings are relatively small, can only lead to the conclusion that standardization of waterway clearances is not feasible. In the interest of economy, both to the bridge owner and to the government, each waterway and bridge must be considered separately. The minimum-size opening sufficient to meet the requirements of navigation during the expected life of the bridge must be determined and the individual bridge built, remodeled, or reconstructed on that basis.

It is to be expected that the Truman-Hobbs Act will exert a major influence in preventing the requirement of excessive clearances and capricious action in ordering the remodeling of existing bridges, because of the resulting cost to the government. Until such time as "easy government money" is exhausted, waterway clearances must be considered carefully in each individual case to prevent waste of government funds and private capital, in subsidies to waterway traffic, which are not even of monetary benefit to that traffic.

Many Factors Determine Benefits or Damages in Alteration of Highway Bridges

J. H. PORTER, M. ASCE
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FUNDAMENTALLY, ALL TRAFFICWAYS are the means of moving goods or persons from one point to another. In modern commerce, highways have become increasingly important, especially around large metropolitan areas and in thickly populated sections of the country. Any delays to the safe and uninterrupted flow of traffic on highways is an economic loss to the community as a whole and, conversely, any construction which expedites the movement of this traffic is an economic benefit. Until recent years not much effort has been expended in attempting to evaluate these losses or benefits. Evaluation has become increasingly important and, in light of the provisions of the Truman-Hobbs Act, especially so as the United States now proposes to release the highway from certain burdens which it has heretofore had to assume.

In arriving at the proportion of costs of any improvements or alterations of bridges crossing navigable waterways to be divided between the highway-, railroad- and waterway-using public, it is necessary to consider the benefits or damages that will accrue to each. Studies have been made for railroads, and more or less standardized, for estimating changes in costs resulting from changed operating conditions. Similar studies have not been so well developed for highways and waterways. One of the best studies the author has found is that made by Fred Lavis, M. ASCE, titled "Highways as Elements of Transportation," published in ASCE TRANSACTIONS for the year 1931. This study is based on the principles of Wellington's "Economic Theory of Railway Location," which is a good point from which to start our studies.

Interested Parties Must Share Burden

Attention is called to one or two aspects of the problem that may help determine methods of approach to the Truman-Hobbs Act for arriving at a more equitable division of costs so that all interested parties will bear their just share of the burden.

A factor of great economic importance in studying comparative costs of new structures is that delays caused by interrupting the smooth flow of highway traffic on heavily traveled roads be reduced to a minimum. A drawbridge with its positive stop to smooth flow causes an expense to traffic that is only measurable when the number of vehicles using the highway and the total time lost in the delays is known. Traffic delays are especially noticeable when a drawbridge is relatively low with reference to mean high water and must be opened frequently for practically all vessels using the waterway. Any alterations such as: (1) The installation of a lift draw instead of the slower swing draw, (2) raising the grade so that openings will have to be made less frequently and only for the larger vessels, or (3) raising the grade to such heights that all vessels can pass underneath, will reduce the total annual cost of delays. This cost capitalized is the amount that could be spent by the highway-using public for the alteration.

To arrive at the cost of delays, it is of course necessary to make a traffic count of the number and type of vehicles which are delayed and the cumulative time that traffic is delayed. The reduction or increase of time in delays through alterations or changes can then be evaluated and the results capitalized to show whether the highway-using public has been damaged or benefited.

Other Factors Considered

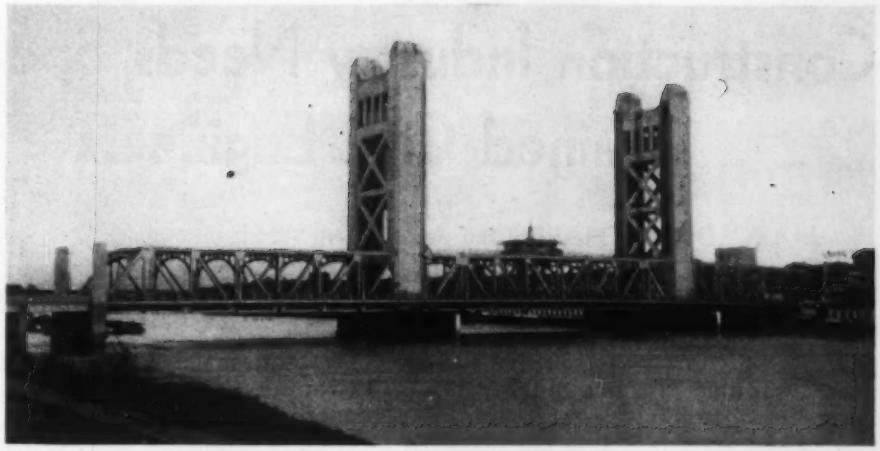
Among other factors to be considered, and for which formulas must be worked out in order that benefits or damages may be determined, are the losses incurred by reason of the decreased use of the highway, the

increased costs due to rise and fall if the alterations include raising the grade, and the benefits received by the bridge owner when the alteration increase the service life of the bridge or decrease costs of operation and maintenance.

Effect on Vehicle-Operation Costs

Where the grade is raised, the increase in rise and fall will have to be considered as a damage to the highway-using public. This does not much affect the passenger automobile, but anyone who has trailed a loaded truck up a steep grade knows that it has an appreciable effect on the operation of a commercial vehicle. Formulas for determining the cost of rise and fall have been evolved by the railroads. Similar studies for highways should not be too difficult.

One of the most difficult problems, and one that will cause a great amount of controversy, is the amount of benefits to the bridge-owner, if any, resulting from installation of a new bridge or from any other changes that would increase the expected service life of the crossing. This will bring depreciation, that old friend of the valuation engineer, into the picture and great controversy will result. It is my personal hope that the formulas or methods by which questions of depreciation will be determined, will be set up by engineers, and not left to legalistic interpretations based on tables set up for the convenience of accountants.



EXPENSE TO TRAFFIC caused by interruption of smooth flow is factor of great economic importance in highway bridge alteration studies. Shown here is vertical-lift bridge with 210-ft span over Sacramento River, Sacramento, Calif. In addition to two traffic lanes and two sidewalks, structure carries one track of electric railroad.

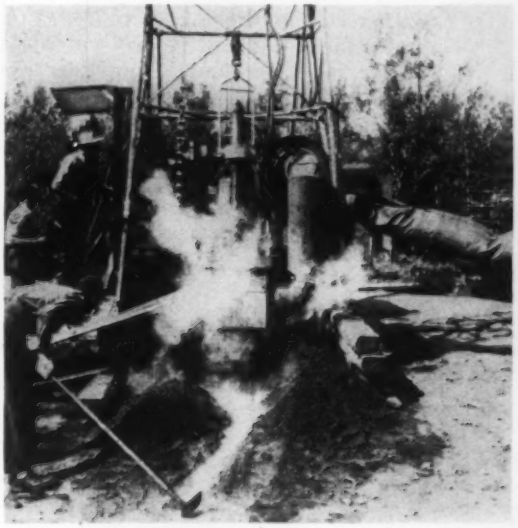
Fusion Piercing Speeds Process of Making Vertical Blast Holes

OF POSSIBLE APPLICATION to heavy construction work is the new method of making vertical blast holes in hard, low-grade iron ore, called fusion piercing, recently tested on the Mesabi Iron Range. In this method increases in drilling speeds of ten times those of older methods have been accomplished.

Flame of High Temperature Utilized

In fusion piercing, a flame—produced by burning oxygen and a flux-bearing fuel in a special blowpipe—is directed against the surface of the rock or ore. The high flame temperature—about 4,000 deg F—causes some types of rock to spall or flake off. Flux in the fuel causes other kinds of rock to melt. Pressure of the burning gases forces the molten material past a water spray, where it is quenched and broken up. In the quenching process water turns to steam and the steam helps the gases force the quenched material out of the hole. Fusion piercing, a patented process, was developed by The Linde Air Products Co., a unit of the Union Carbide and Carbon Corp.

Speed in making blast holes helps reduce mining costs in large-scale operations. In addition, it has been found that the high-temperature piercing flame produces stresses in the surrounding ore which cause better fragmentation during primary blasting, further reducing costs. Mining men who saw the tests say that fusion piercing will have many advantages in the mining of low-grade ore.



FUSION PIERCING EQUIPMENT for commercial use is still in development stage. For field tests, truck is equipped with portable oil-field drill rig with 30-ft special blowpipe (replacing "kelly"), pumps, tanks, motors, and special recording instruments.

IN FIELD TESTS made on Minnesota "taconite," an extremely hard, tough, abrasive, low-grade iron ore, 6-in.-dia holes up to 30 ft deep are fusion pierced at average rate of 10 ft per hour—at rates as high as 17 ft per hour for short periods. This compares with average speed of about 1 ft per hour for drilling holes of same diameter in this ore.

Construction Industry Needs Specially Trained Civil Engineers

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CONSTRUCTION IS CIVIL ENGINEERING'S biggest industry. In fact, it is one of the nation's biggest industries, normally accounting for more than 10 percent of the economy of our country. It is big business, running as high as 15 or 16 billion dollars annually, and the prophets see 20-billion-dollar years ahead in construction. Furthermore, construction is the main support of civil engineering, for the profession is largely compensated by a share of the total costs of construction projects. The prime purpose of civil engineering is to provide the physical works that serve mankind. That purpose is not fulfilled until the physical structure has been designed, built, and put into service. Does it not seem logical then that civil engineering education should pay considerable attention to this important branch of the profession?

CIVIL ENGINEERING EDUCATION should recognize importance of modern construction processes and equipment which makes them possible. Here, highly mobile General Supercrane speeds erection of new coal tipple near Cleveland.

CONSTRUCTION HAS BECOME highly mechanized, especially in the past few years. For untold centuries it depended upon human labor, assisted by crude tools and, to some extent, by beasts of burden. Mechanization started in the last two decades of the nineteenth century with the invention of the steam shovel and its adoption, along with railroad-car haulage, on railroad construction. The Chicago Drainage Canal, in the closing years of the century, gave further impetus to development of machines for earth moving.

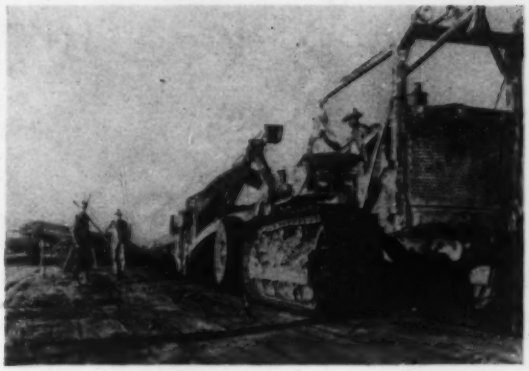
Many early contractors still in business today have seen the evolution of the scraper from small slips, through wheelers, to the latest big carrying pans. They have seen crawler tractors replace mules, and high-speed wheel tractors supplement the crawler type. They have seen the modern large-capacity precision-control concrete mixers and pavers grow out of the old continuous mixer and the crude hand-charged machines. They have seen the development of cranes, derricks, hoists, draglines, pumps, graders, rollers, compressors, welders, asphalt equipment and the whole gamut of modern construction machinery. They have witnessed the birth of scores of useful and efficient small tools, such as power saws, pneumatic and electric drills and spades, grinders, and generating sets, to mention just a few.

Modern equipment makes modern construction possible, for mechanization of the construction processes has kept costs within economical limits so that individuals, industry, business and the public can afford to buy the construction they need. Construction equipment played a tremendous part in winning the war. Literally, bulldozers came first, often ahead of the guns and bombers in military expeditions.

Construction is big business, a complex, strenuous, highly competitive business. It is essentially a civil engineering business, for it is based on

EVOLUTION OF SCRAPER from small slips (below) through wheelers, to huge carrying pans (right) is but one of many developments in construction equipment that have taken place over relatively short period of time. GarWood 515 scraper, at right, is drawn and pushed by Allis Chalmers HD-14 tractors.

MODERN CONSTRUCTION EQUIPMENT and techniques used by Army Engineers and Seabees are major factors in obtaining early victory in last war. Outmoded methods of Japanese are sad commentary on their airfield construction efforts. Pushcarts on narrow-gage railway (left, above)—found on unfinished Jap airfield on Saipan Island, Marianas Group—are no match for our modern machinery (right, above) which made short work of converting that island into base for B-29's. Caterpillar D-8 tractor and carrying scraper (right) are typical of heavy equipment disassembled and flown into Burma to construct air bases for flights over "the Hump" into China. Official photographs, U.S. Army Air Forces.



the fundamental principles and concepts of that branch of engineering. Construction is a business of planning, of marshaling men and machines into an efficient operating unit, of knowing and controlling costs, a business of human and industrial relations, of skill and ingenuity. It touches law, accounting, safety and the social sciences. It involves geophysics, mechanics and the use of electricity.

At one time construction leaders and key men were self-made, working up from the ranks. Today the majority are civil engineering graduates and they look to engineering schools to furnish the young blood necessary to carry on the industry. Construction, as civil engineering's biggest industry, a highly mechanized procedure, and a business largely conducted by civil engineering graduates, certainly deserves a place in civil engineering curricula.

Of course construction does not expect, nor does it want, engineering colleges to turn out finished construction men. That would be impossible, for construction is largely an art of experience, gained only by actual performance in the field. But construction does expect, and deserves, engineering graduates who have had basic training in certain fundamentals of the business.

A few civil engineering schools make an attempt to include construction courses, and a few more offer a smattering of subjects somewhat related to the business. But in no case is a real, serious effort made to train students for a life construction career. One reason, perhaps, is that some engineering educators are still prone to regard the construction man as a roughneck, a glorified laborer or mechanic. Actually, he is most likely to be a keen, alert, high-class citizen, an ingenious and shrewd operator, a technician with good business sense. Some educators regard construction training solely as a function of trade schools. That type of training is not being discussed here. Educated construction men, not skilled mechanics, are being considered. Other educators have failed to note the advances in mechanization, and in doing so have ignored the greatest impetus to practical civil engineering in modern times.

Schools Reluctant to Change Curricula

However, the greatest obstacle to introduction of construction courses in technical colleges seems to be a reluctance on the part of civil engineering schools to adopt new courses or to readjust the curriculum. Certainly we all agree that the standard four-year course is well crowded with subjects. We recognize the pressure for special courses of all kinds. We are aware of the growing demands for more liberal subjects, such as social sciences and the so-called humanities.

Yet, because of the fact that these various demands are being made, and because we are entering a new era of industrial achievement where the world is to take advantage of the accelerated progress of wartime developments, is it not time we thoroughly revaluated our civil engineering training? Is it not time to see whether our courses are best fitting the undergraduate for careers in this new world? Some schools still require civil engineering students to take such courses as Economic Theory of Railroad Location. Can such colleges honestly say they have no time or room for studies far more useful to today's student?

It is not the purpose of this paper to outline courses in construction, but to point out the need for them. However, a few suggestions are in order. Contract law and specifications are already taught in most schools, but these subjects might well be strengthened, for they are the basis of the construction business. Estimating and cost-keeping are also fundamental to construction, and deserve far more attention than they get in the average course today.

The subject of labor relations is about the first obstacle a neophyte constructor runs into upon leaving school. Why should he not at least be prepared with previous study of this all-important subject? Fundamentals of construction management, including safety, and job planning are

MECHANIZATION OF CONSTRUCTION processes keeps costs within economical limits so that individuals, industry, business and public can afford to buy construction they need. Here Northwest 1¼-yd dragline loads gravel into Caterpillar DW 10 Wagon drawn by DW10 Tractor, on road job in Tennessee.

requisite to the training of the construction man. Construction, as stated before, is a business, a complex, highly competitive business. How that business is conducted, how it is planned and carried on, would be most valuable knowledge for a student bent on a construction career.

Job management largely means equipment management today, for successful construction is mainly the intelligent use of the excellent tools and machines now available. The construction student should have a basic knowledge of equipment—the various types, their purposes and applications, their working capacities and their limitations. Proper equipment use is a question of economics. The student should at least know the approximate first cost of major types of machines and how to figure operating and production costs. A working knowledge of care and maintenance of construction machinery is also necessary, though it is not the place of a college course to delve very far into the operating mechanics of equipment—that is a function of trade schools.

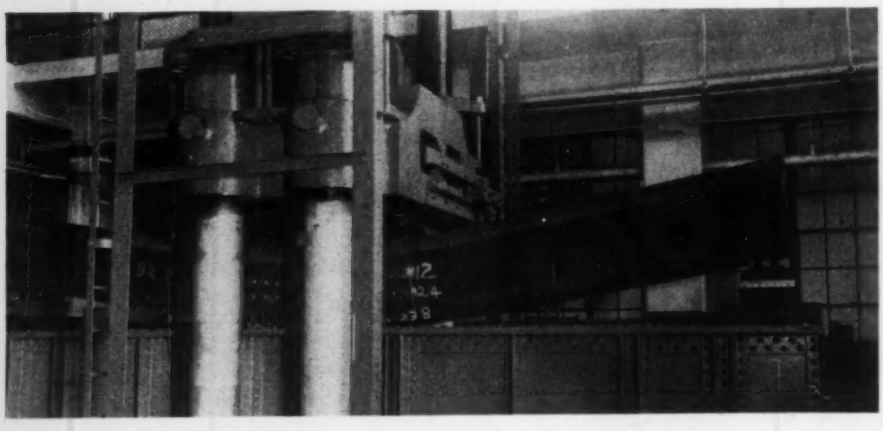
Form design and erection is another important construction subject. Much attention is given the design of many types of complicated concrete structures, but hardly a thought is paid to the fact that every bit of concrete must be encased in some kind of a form. The number of subjects that might be included in a construction course is as limitless as construction itself, but those mentioned are the more important ones. They should, of course, be supplemented by laboratory work, and field contacts. It is not proposed here to argue the merits of cooperative courses except to state they are admirably suited to construction training.

Construction courses might well be set up as electives to be taken by those students desiring such training in place of some of the higher design work or other specialized theoretical studies. Some progress is being made in setting up construction education courses. Professor Evinger, of the University of Nebraska, who heads a committee of the ASCE Highway Division studying the subject, reports that three universities—Stanford, Illinois and Columbia, are interested in establishing such courses. The American Road Builders' Association also has an active committee at work, and the Associated General Contractors of America have shown interest.

The need for construction education is great. It is hoped that, as a result of the preliminary work now being done and the interest shown by the field, before long American youth will have an opportunity to train for a career in construction, one of the nation's greatest industries.

This paper was presented before the Highway Division at the New York Annual Meeting.

Progress made by the ASCE Construction Division Committee on Construction Education—along the lines proposed in this article—is reported in the item titled, "ASCE Division Committee Expands Opportunities for Construction Engineering Education," page 100 of this issue.



WELDED GIRDER OF FULLY KILLED STRUCTURAL STEEL sustains load of 1,685,000 lb. Center deflection of 9-ton, 22-ft test girder is 18.06 in.; permanent deflection after removal of load is 16.45 in. Third in series of tests undertaken by Structural Steel Committee of Welding Research Council at National Bureau of Standards, investigation is part of research program examining effect of severe geometrical constraints and of residual stresses in large welded steel structures.

Simple Model Tests Predict Aerodynamic Characteristics of Bridges

Part II. Response Curves Computed from Static Lift and Torque Graphs

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Part I of this paper—published in the January 1947 issue of CIVIL ENGINEERING*—describes a method for computing aerodynamic response curves for a given section from pressure-distribution curves obtained from simple laboratory tests of section models. An alternative method is presented in this concluding installment, together with new concepts for future test procedure.*

THE ALTERNATIVE METHOD of deriving and plotting the aerodynamic response curves is to use the static lift and torque graphs of the section, obtained by holding a small section-model stationary in a wind tunnel. A valuable series of such graphs, for H-sections and for deck sections, has been obtained for the writer and generously contributed by Prof. F. J. Maher, using the wind tunnel at Virginia Polytechnic Institute. In Figs. 8 and 9 appear typical lift and torque graphs, respectively, for H-sections. The slopes of these graphs, at any angle of incidence, provide the criterion and the measure of aerodynamic stability. A positive slope denotes *stability* and a negative slope denotes *instability;* and the steepness of the slope determines the degree of stability or instability.

If s is the slope of the lift graph and s_t the slope of the torque graph, s is a measure of the lift resultant on the section (actually the increment of lift per unit increment of angle of incidence), and $e = s_t/s$ is the eccen-

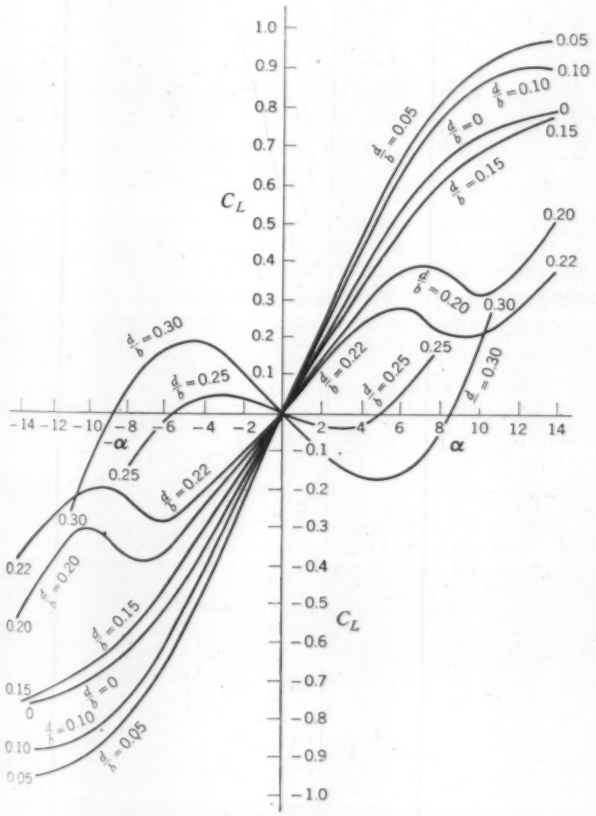

FIG. 8. TYPICAL STATIC LIFT graphs of H-sections (d/b = 0 to 0.30).

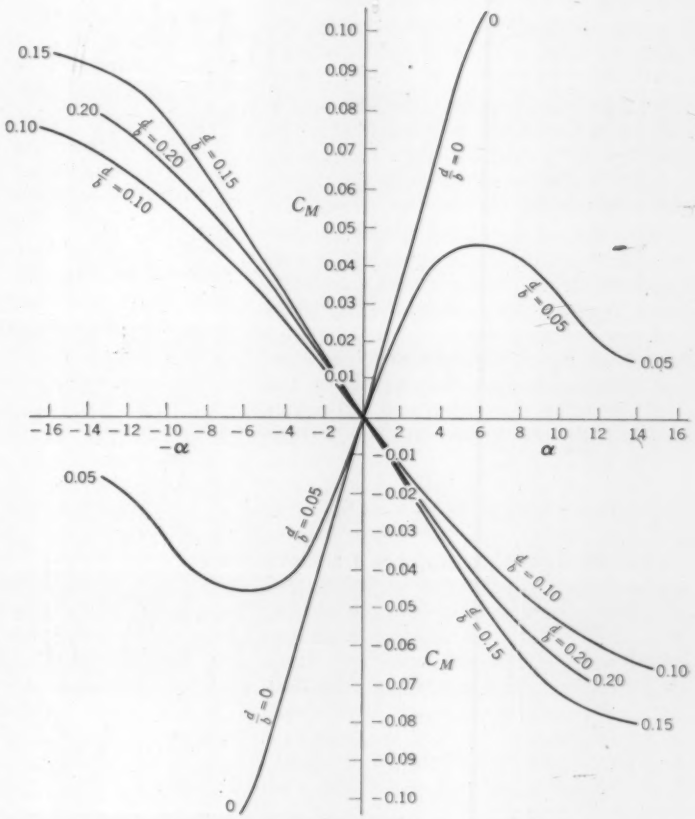

FIG. 9. TYPICAL STATIC TORQUE graphs of H-sections (d/b = 0 to 0.20).

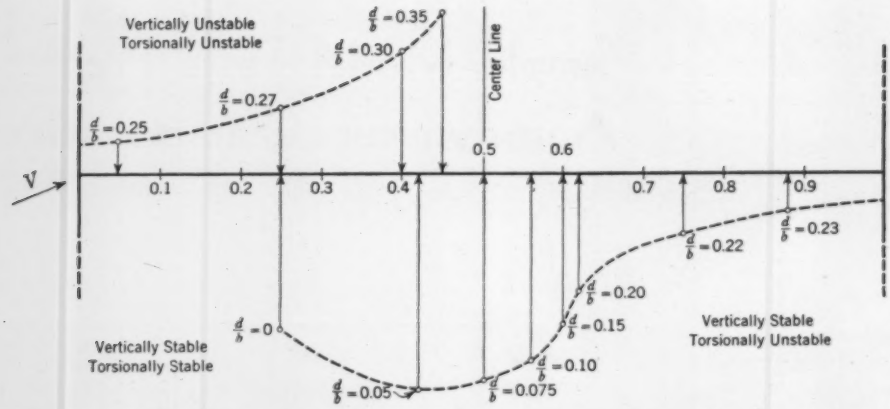

FIG. 10. AEROSTATIC RESULTANTS on H-sections (per unit angle of incidence).

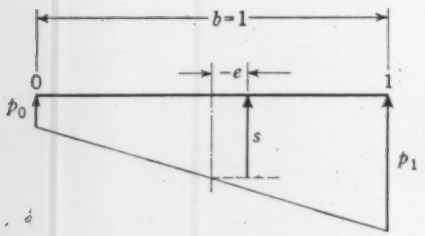

FIG. 11. STRAIGHT-LINE PRESSURE distribution across a section, for approximate method. Compare with Fig. 1.

tricity of the resultant, its distance from the center line. By using these simple relations, we obtain Fig. 10, showing the magnitudes and the points of application of the lift resultants produced by a small upward angle of incidence on H-sections of varying section ratio. If the resultant is in the lower left quadrant, the section is *vertically and torsionally stable;* if the resultant is in the lower right quadrant, the section is *vertically stable and torsionally unstable;* if the resultant is in the upper left quadrant, the section is *vertically and torsionally unstable.* Border-line cases are *neutral* sections.

Assuming a straight-line pressure distribution across the width of the section (Fig. 11), the end ordinates p_0 and p_1 are given by the simple relation

$$p_0 = s + 6s_t, \quad p_1 = s - 6s_t \quad . \quad (6)$$

If this straight-line graph of p is used in Eqs. 3 and 5 instead of the actual pressure-distribution curves illustrated in Figs. 1–3, almost identical results are obtained, yielding aerodynamic response graphs sufficiently accurate and informative for all practical purposes. In Fig. 12 is given a comparison of the torsional instability graphs computed by the two methods (using the two kinds of test data from two different laboratories) for an H-section of $d/b = 0.16$.

Deck and Through Sections

If the horizontal deck of an H-section is moved to the top or bottom of the section, there is only a slight shift of the static lift graph, without any material change in slope or form. But the static torque graph undergoes a substantial modification and displacement. In Fig. 13 are shown the static torque graphs (plotted from Prof. Maher's tests) for an H-section, deck section, and through section, all having the same section ratio of 0.20. These graphs show why the deck and through sections are torsionally stable in horizontal wind, and become torsionally unstable at about +5 deg incidence (upward inclined wind) for the section with top deck, and at about −5 deg incidence (downward inclined wind) for the section with bottom deck. For a deck at $^1/_4$ or $^3/_4$ height, intermediate results are shown by the wind-tunnel tests.

From the slopes of the curve in Fig. 13, the torsional instability graphs for the deck section are computed and plotted in Fig. 14. The graph for zero degrees incidence corresponds to a *neutral* section, with only a negligible hump of slight potential instability below $V/Nb = 1$, and with uninterrupted stability at all higher velocities. But the graph for upward inclined wind at 5 deg shows torsional *instability*, with a catastrophic range above $V/Nb = 3$. The same two graphs would be obtained for a bottom-deck section at zero and −5-deg incidence.

Use of Curved Models

Curvature of the section model in static wind-tunnel tests, as the equivalent of angular oscillation of the section, is a new concept introduced by the writer. (A search of aerodynamics literature reveals that a similar idea has been applied in the study of curvilinear flight of airships.)

In the case of vertical oscillations, with all points of the section having the same instantaneous vertical velocity v (assumed downward), if V is the horizontal wind velocity, the diagonal resultant of V and $-v$ gives the effective angle of incidence (inclined upward); and the diagonal resultant of V and v (without reversing v) gives the equivalent tilting of the model in the opposite direction to obtain the same results in the horizontal wind of the wind tunnel. The *tilting* of the stationary model in a horizontal wind takes the place of a *vertical velocity* of the section.

For torsional oscillations, the corresponding reasoning is represented in Fig. 15. In this case the instantaneous vertical velocity v varies (in straight-line ratio) and reverses across the section, passing through zero at the center of rotation. Consequently the resultants of V and $-v$ yield a varying angle of incidence, following a curve with horizontal tangent at the mid-point, as though the section were held in a curved or arching field of

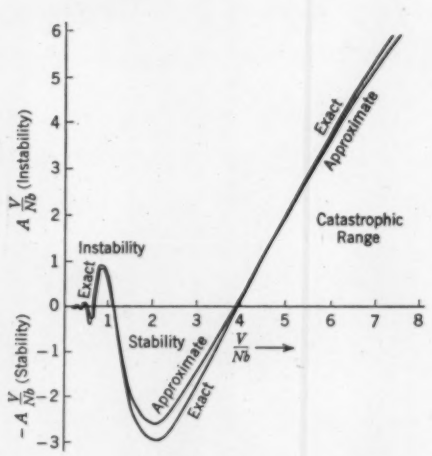

FIG. 12. COMPARISON of instability graphs for H-section ($d/b = 0.16$) by exact and approximate methods.

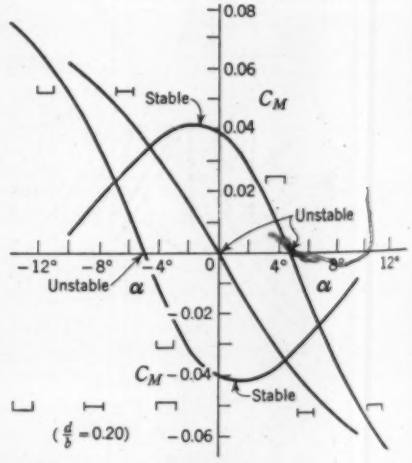

FIG. 13. COMPARISON of static torque graphs for H-section, deck section, and through section ($d/b = 0.20$).

flow in the wind tunnel. Instead of attempting to provide a curved field of flow, it is of course more convenient and practical to use the straight, horizontal flow in the wind tunnel and to curve the model instead. As shown in the lower diagram, the diagonal resultants of V and v give the equivalent curvature of a model (a simple circular arc). This *curvature* of the stationary model in a horizontal wind takes the place of an *angular velocity* of the section.

With a curved section model, the angle of incidence at the leading edge remains v/V.

Wind-tunnel tests on such curved section models are needed in order to determine the correction from the straight section models hitherto used. The qualitative results and conclusions will be substantially unchanged, but the numerical values (for torsional instability) will be modified.

The concept of warping the model to represent angular oscillation readily explains the torsional stability of flat plates (Fig. 16). Horizontal flow against a warped horizontal plate (concave upward) obviously produces a stabilizing torque (upward at the leading edge, when the leading edge is moving downward). This also applies to shallow H-sections.

The same representation also readily shows how a central opening or gap (as in the original deck of the George Washington Bridge) would

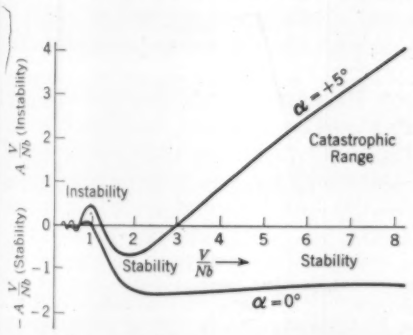

FIG. 14. TORSIONAL INSTABILITY graphs for deck section (d/b = 0.20) for angles of incidence of 0 deg and 5 deg.

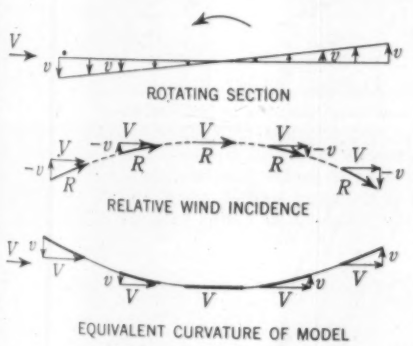

FIG. 15. CURVATURE of stationary model to represent angular velocity of section.

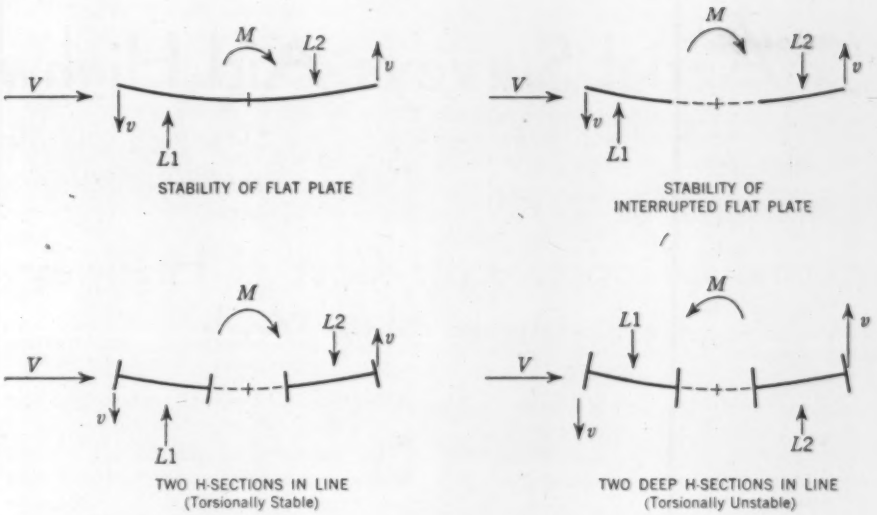
STABILITY OF FLAT PLATE
STABILITY OF INTERRUPTED FLAT PLATE
TWO H-SECTIONS IN LINE (Torsionally Stable)
TWO DEEP H-SECTIONS IN LINE (Torsionally Unstable)

FIG. 16. TORSIONAL STABILITY explained by equivalent warped sections.

improve the *torsional* stability of a flat plate by increasing the lever arms of the stabilizing resultants.

The same representation also readily explains the pronounced torsional stability of a section composed of two H-sections in line with an open gap between them. The upward resultant on the first H-section and the downward resultant on the second H-section are on opposite sides of the combined center of rotation and therefore produce a strong stabilizing torque. If, however, the two H-sections are deep ($d/b > 0.25$), the two lift resultants are reversed and torsional instability is obtained (Fig. 16).

Any representation that facilitates visualization and explanation also facilitates prediction and inventive solution.

Additional Tests Needed

Tests are needed covering other forms of bridge sections, including truss sections, of varying forms and proportions; compound, tandem, and double-deck sections; sections with lateral vents or open slots in the roadway; sections with outside sidewalks or cantilever brackets; and other variations offering improved aerodynamic stability. These tests may be of either type, pressure-distribution curves or static lift and torque graphs, or preferably both. Tests on *curved* section models are needed for accurate quantitative determination of torsional stability parameters. These tests on *stationary* section models should supply all the basic data needed for exploration, prediction and design.

In addition, tests on *oscillating* section models are desirable, in order to verify or modify the numerical coefficients and to confirm the underlying theory. Furthermore, oscillating model tests in still air should supply all the needed data on *atmospheric damping*, thereby completing the aerodynamic investigation. All these tests may be on small-scale models, not exceeding a foot or two in length.

In the foregoing presentation, all the emphasis has been on the *aerodynamic* (fluid mechanics) phase of the problem. The *elastic* (solid mechanics) phase of the problem is comparatively simple, and has been covered by the writer in easily applied formulas reduced to utmost simplicity. No tests are needed. Much valuable time and laboratory resources have been misdirected to this phase of the problem; simple integration yields formulas that will answer all questions on oscillation modes and frequencies more accurately than the most elaborate and spectacular large-scale model tests.

The only remaining element of the problem requiring experimental study is the *structural damping* or hysteresis. Large-scale laboratory models of bridges yield misleading results because they do not reproduce the structural damping of the prototype. Properly planned tests are required on actual structural elements (beams, girders, trusses, and rope strands), also tests on actual suspension bridges, in order to verify the indicated laws of energy absorption and to determine the numerical coefficients. Once this unknown factor of structural damping is determined, the entire challenging problem of bridge aerodynamics is resolved into known elements readily applicable in design.

Aerial Surveys Aid Highway Location

Symposium Presented Before Surveying and Mapping Division at New York Annual Meeting

Aerial Mapping Cuts Cost of Highway Location in New York

EDWARD T. GAWKINS

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DESIGN OF A HIGHWAY presents a problem which in many respects is quite similar to that of designing a machine. The comparison is even more pertinent in the case of locating and planning a new highway facility such as a throughway, parkway, or urban arterial system. In these instances an element of the highway system must be integrated with the existing facilities to perform a specific function in much the same way that a new, complicated machine is added to increase the production potential of a vast manufacturing assembly line.

An industrial-machine designer would not approach his problem by first designing cover-plate studs, gear pitch, or shaft diameters. His approach would be to determine first the function the new unit was to perform, the space available and required for it, economic considerations, and correlation with the plant operation as a whole. A highway design problem can be better approached from a perspective aerial view than through the limited field of a transit telescope.

The pioneers of the aerial photographic art realized the advantages that would accrue to the highway planner through an approach to his problems from the air. The foregoing analogy in all probability never occurred to them, but an awareness of the underlying principles was the source of much of the enthusiasm and energy with which they advanced their techniques and promoted their enterprise. It was inevitable that the highway engineer should come to share their belief in the benefits to be had from aerial photographic aids.

The writer was in the Department's (N.Y. State Department of Public Works) district office, at Babylon, Long Island, during the early boom in parkway development in that area. Nassau County had been completely photographed from the air by 1926. Similar mosaics had been made of all of Suffolk County by 1930, both projects having been contracted for by the respective counties. Our work in planning the major east and west highways and parkways was materially aided by the use of individual prints of these mosaic maps, which were made available to us by the counties. Notwithstanding some undesirable features in these early mosaics, such as scale or seasonal conditions which detracted from their usefulness, we found them a great help.

Those early uses of aerial mosaic maps marked the obscure beginning of a mutual interest between the highway engineer and the photogrammetry engineer which has, beyond a doubt, contributed to the development of the aerial surveying art.

About 1929 it became necessary to construct a new bridge over the Hudson River at the south end of Troy, N.Y. The problem of determining the best location for the structure was intensified by the presence of residential and industrial buildings strung out along the east bank at the

AERIAL PERSPECTIVES ARE INVALUABLE in presenting proposed urban arterial designs to public, as well as to local officials and engineers, in development of acceptable solutions to urban traffic problems. Shown here is oblique aerial view of downtown Buffalo on which is depicted part of proposed Niagara Throughway and connecting urban arterial routes.

foot of an irregular bluff. An aerial mosaic map, at a scale of 1 in. = 400 ft, was made of the area and from it the final location of the bridge and its mile-long approach were determined at a small fraction of the cost of ground survey methods.

A group of matched aerial prints pasted down on a board is not necessarily an accurate map. If the proper engineering steps are followed and the terrain is fairly level, however, a most satisfactory map can be made. The location of detail on such a mosaic can be held to within two or three one-hundredths of an inch of its correct position. Errors in scaled distances due to this tolerance will, naturally, depend upon the scale at which the map is made. It was mosaic maps of this character that were used by the Department in connection with its early parkway planning from 1930 to 1940. They proved to be most helpful.

These early maps varied in scale from 1 in. = 600 ft to 1 in. = 100 ft, depending largely on the terrain and degree of development. The location of buildings, existing roads, railroads, cemeteries, orchards, woodlands, natural features, and general land use can be readily determined. These all have an important bearing on the final location of a highway facility from both the economic and the functional viewpoint.

Scales of Maps Vary

Generally speaking, the rougher the terrain or the higher the degree of development of the area, the larger will be the scale at which it must be photographed in order to yield satisfactory information. When the area in question is fairly level and the topography is reasonably uniform, an aerial strip map should be adequate. If such a level area is rural in nature, an original negative, at a scale of 1 in. = 1,000 ft or 1 in. = 800 ft, is adequate. This is particularly true if the route is fairly well determined.

If however a rougher region, or one that has been partly developed, must be scouted from scratch for a highway line, then a scale of 1 in. = 500 ft, or 1 in. = 400 ft, may be required to reveal enough information on which one can confidently proceed. The most densely populated areas will require scales ranging up to as large as 1 in. = 100 ft. The suggestions and advice of reputable organizations which have had many years of experience will be helpful in selecting the best scale. With the present-day methods of radial-line control used by the large aerial survey organizations, a mosaic from corrected aerial photographs can be made of fairly level country as accurately as a line-drawn map on tracing cloth from ground survey notes at the same scale.

TROY-MENANDS BRIDGE, with mile-long westerly approach, is result of aerial mosaic map study to determine most economical alinement.

The production in recent years of exquisitely fine lenses in the longer focal lengths and refinements of other camera details now permit the airplane to be flown at the safe altitude of 7,200 ft while securing aerial negatives to a scale of 1 in. = 300 ft. This development is a distinct advantage in photographing highly congested areas where ground-survey map accuracy can be approached by the aerial map up to scales of 1 in. = 100 ft, and which also provide the only possible economical means of securing all of the detail.

Survey Costs Cut

The Department continued to use aerial survey maps for various projects and purposes over the years preceding the outbreak of the war. In 1941 we were confronted with the problem of making a strip map for the Palisades Interstate Park Commission showing the location of 31 miles of proposed parkway. On account of the rugged nature of the Ramapo Mountains on the west side of the Hudson River, through which the parkway was to be constructed, our division engineers estimated that the cost of a ground survey covering a strip 300 ft in width by 31 miles in length would be approximately $75,000. This sum was three times the total funds allotted to the Commission for a complete location study. At this time an aerial photographic concern offered to make a topographic map at a scale of 1 in. = 200 ft, inked on tracing cloth, showing 5-ft contours as well as all the planimetric detail such as houses, roads, streams, railroads, woodlands; and in addition to furnish a set of aerial photographs of the 1-mile-wide strip shown by the map—for a total cost of $17,600. Under the circumstances we accepted the bid and awaited results.

It was our first experience with topographic maps produced from stereoscopic study of aerial photographs. The contractor did all the necessary field survey work required to control the accuracy of the map and guaranteed to meet the specifications regarding the accuracy of contours. The specifications required that 90 percent of all elevations interpolated from the finished map be correct to within one-half of the contour interval, that is, within $2^1/_2$ ft. The remaining 10 percent were to be in error by no more than one contour interval, or 5 ft.

The aerial survey work was completed to the satisfaction of the Palisades Interstate Park Commission. The Department was so favorably impressed by the work and its economy that it entered into a contract for similar maps in connection with the preparation of preliminary location plans for the connecting highways at the terminus of the Palisades Interstate Parkway.

Ground Surveys Also Needed

The writer does not wish to imply that aerial surveying will dispense with ground surveying. Far from it. However, it will in most cases obviate the need for one or more reconnaissance surveys and all the labor required for preliminary estimates of several alternate routes. Once the

line has been selected from the use of aerial surveys, field surveying can be reduced to include only those necessary steps such as laying out of base line, setting of stakes, determination of right-of-way limits on the ground, and taking of sections for earthwork estimates prior to the award of the contract—the steps that will always be required for the construction of a highway.

Check Shows High Degree of Accuracy

An interesting check was made by the Park Commission to determine the accuracy of the estimate of quantities based on the aerial survey as compared with the final estimate made from ground surveys. A section 1 mile in length, near the northerly end of Palisades Parkway where the terrain is particularly rough, was taken as an example. Cut-and-fill quantities on both the northbound and the southbound arteries were used as a basis for comparison. A total of some 330,000 cu yd of material was involved.

Comparison of these quantities as estimated from the aerial topographic map and as computed from the field-survey cross-sections revealed that total fill quantities from the aerial survey overran the ground survey quantities by 4.1 percent. Oddly enough, the total of cut quantities as obtained from the aerial topographic maps underran those from the ground survey estimates by 4.2 percent. The total combined error was 0.4 percent, on the safe side, with the aerial estimate being the higher.

It might be argued that these tolerances are acceptable for estimating a preliminary grading contract and would therefore permit postponement of the taking of field sections until after a contract is awarded. In my opinion this procedure could be condoned only under circumstances demanding the utmost urgency in getting a project under way. The Department is rather proud of its tradition of making a complete design and of getting that design into a comprehensive set of detail plans for the guidance of the contractor. With all due respect for the efficacy of aerial surveys, we expect to continue to base our detail designs and estimates on the work of the field survey party.

Numerous Aerial Surveys Planned

Since the mapping of the Palisades Interstate Parkway we have let contracts for a number of aerial surveys. These include all the Catskill Throughway, the western half of the Mohawk Throughway, the Berkshire Throughway, and the Taconic State Parkway Extension, a total of approximately 300 miles of strip map.

At the present time we have contracts in effect for topographic maps to assist in the planning of highway by-pass routes in seven separate areas of the state. These particular areas are relatively small, ranging from 5 to 15 miles in length, and for that reason the unit cost is somewhat higher than it would be for longer strips. The average cost of our aerial topographic maps has been about $1 per acre for a strip 1 mile in width. That price includes a set of vertical aerial photographs at a scale of 1 in. = 500 ft. The cost is but a fraction of what a ground survey would be.

The Department's Bureau of Soil Mechanics is using aerial photographic aids to an ever-increasing extent in the many phases of its work. At present it is utilizing photographic prints at a smaller, more convenient scale of 1 in. = 1,666 ft. These prints are obtained from several federal and commercial agencies which can, collectively, provide photographs of a large part of the state. These small-scale photographs are used to help determine soil characteristics, presence of construction material, significant geological characteristics and conditions, natural and subsurface drainage, and other features of the area through which a route will pass. The most important use of such prints is in determining locations at which test holes will be productive of the most information.

Increased Usefulness Predicted

There are many other uses for aerial photographs in highway work, such as oblique shots for arterial routes in cities, traffic flow and congestion studies, location of traffic lights, parking facilities, railroad grade crossing elimination studies, and others. The ever-widening use of aerial aids suggests still more applications. We have only begun to utilize this modern tool in the design of our highways. It is reasonable to expect that its effectiveness will increase to a degree that we dare not now predict.

Connecticut Applies Aerial Mapping to Urban Highway Planning

WILLIAM J. COX, M. ASCE
State Highway Commissioner, State Highway Department, Hartford, Conn.

SMALL, DENSELY POPULATED CONNECTICUT has a topography which, from the standpoint of the highway engineer, can be described as moderately difficult. Without the ruggedness of high mountains, it also lacks the level plains of the great valley areas. If problems of terrain were the only ones encountered in the location of highways in Connecticut, the state would probably be considered as having average, or a little more than average difficulty in this phase of its highway work.

The problems presented by terrain, however, are considerably aggravated by the density of the culture lining the state's heavily and moderately traveled highways. In Connecticut's concentrated industrial and residential areas, the works of man not only closely line the major roads, constricting them within existing limits, but they also extend for considerable distances to either side of the highway arterials, complicating the problem of finding new locations. Connecticut's urban highway problems are doubtless no more difficult than those encountered in many other places; but the state is so highly urbanized that it has a great many such problems.

In the earlier periods of highway location, construction was held very close to existing alignments of the roads undergoing improvement. As traffic increased through the years however, it became necessary to straighten curves and to improve sight distances by constructing more moderate grades. As traffic increased beyond any early expectation on the main roads, it was essential to depart radically from existing rights-of-way in order to meet accepted standards of modern and safe highway design. This meant extensive investigation of the topography and of the works of man over wide areas. Ordinary "strip surveys" depicting culture data and topography just at the highway margins were no longer adequate to show conditions influencing relocation work.

Wide use was made of the U. S. Geological Survey maps in selecting possible new alignments and gradients, but as these maps were based

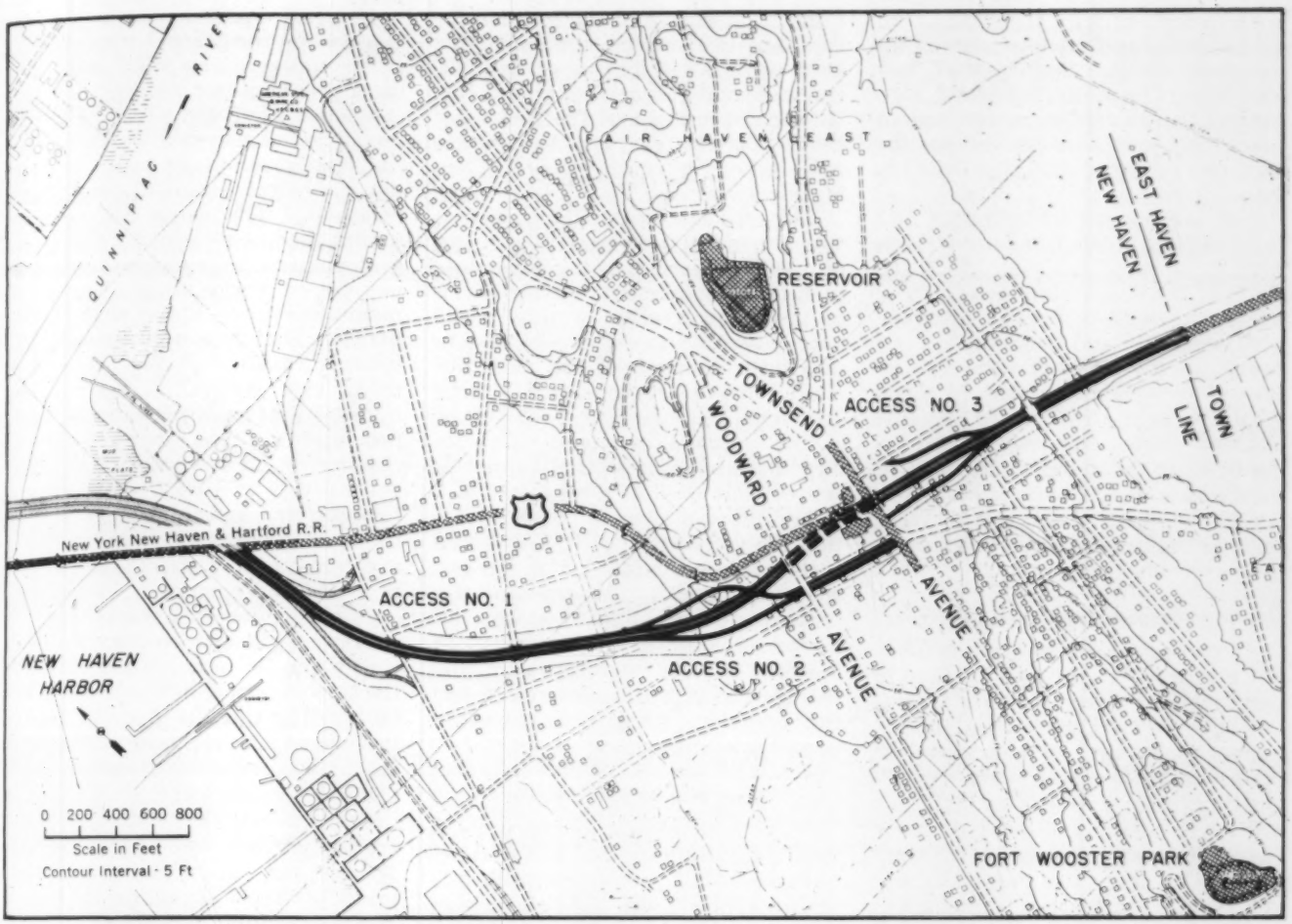

FIG. 1. REPRODUCED FROM ONE-MILE-WIDE STRIP MAP—made in 1946 from aerial photographs—plan shows superimposed heavy black lines which indicate first stage of proposed reconstruction of Route U.S. 1 in New Haven, Conn. Section to west, shown shaded, is later stage of project. Line location and ramp connections are plotted wholly from topographic and cultural information on original aerial survey map.

on surveys conducted before 1893 the culture was outdated, and although the contours were generally fair in accuracy, the interval was too great to permit the preparation of reliable advance estimates on which to base reconnaissance surveys. The need for other maps was therefore apparent.

The first air survey used by this Department (Connecticut State Highway Department) was produced some time between 1920 and 1925, and showed a narrow zone of photography across the state along the then course of Route 1, the Boston Post Road. Little information is available as to the exact nature of this air strip map, its scale, the area encompassed, or the exact use made of it. Perhaps the intention was to appraise the existing alignment of the state's most important highway and thus evaluate the obstacles that would have to be taken into consideration in relocating portions of it.

A photographic mosaic was made of the entire state, also during the early 1920's, probably by the Fairchild Aerial Surveys, Inc., of New York City, from an air survey by the U.S. Army Signal Corps. This map, covering the state to a scale of 1 in. = 1 mile, was mounted on a single sheet of canvas, approximately 8×15 ft. It was used for various purposes, but these did not include highway location.

This aerial photograph of the entire state, however, was the forerunner of, and quite possibly one of the inspirations for, a much more elaborate aerial survey made in 1934. This survey resulted in the production of a photographic map of the entire state, to a scale of 1 in. = 600 ft, on 244 sheets, each 40×54 in.

Aerial Maps Find Many Uses

These sheets have been invaluable for many purposes, and from the time of their production until now have been in continuous use. They have been particularly helpful to the engineer of location and design, the engineer of design, the five resident engineers, the director of highway planning studies, the engineer of rights-of-way, and the director of roadway maintenance.

It is probable that the engineer of location and design and his staff use the air maps more than any other office of the Department. All lines to be run in the field for major or important projects are laid out first on the air map or maps. When they are plotted, the geographical positions of horizontal control points are established and computed, and their locations are identified on the ground for the guidance of those who are entrusted with the conduct of the preliminary investigations and the preliminary surveys. Such physical characteristics as would influence the establishment of a line or zone of location are carefully evaluated and appraised prior to the commencement of the detailed ground surveys.

Within the last several years, especially during 1942 and 1943, the U.S. Geological Survey has issued a new series of topographic maps of Connecticut covering about one-half of the area of the state. These sheets

are to a scale of 1 to 21,680 (or 1 in. = 2,640 ft), and have a contour interval of 10 ft. During 1942 and 1943, the Corps of Engineers, U.S. Army, issued topographic maps covering about one-quarter of the state not covered by the U.S.G.S. maps.

The Army maps are to a scale of 1 to 25,000 (or about 1 in. = 2,100 ft), with a contour interval of 20 ft. Both of these are marvelous sets of maps with high degrees of accuracy both vertically and horizontally. Of course, as the scales of these two issues of topographic maps are much greater than the 1 in. = 600 ft scale of the 1934 air maps, they cannot begin to show the detail comprehended by the air maps. Consequently, they do not supplant, but they do very usefully supplement, the 1934 maps which are without contours.

Opposition to Surveys

At the time surveys for the Merritt Parkway were first undertaken in the towns of Greenwich and Stamford, Conn., there was almost unanimous opposition to encroachment on private property for the purpose of locating a major road through this area. To the inhabitants of these towns the idea of a major highway through or near their properties was abhorrent. Although Connecticut statutes give the highway commissioner the right to enter upon private property for purposes of survey, those who were unfortunate enough to be members of a survey party were treated with scant consideration by irate property owners. Investigating various alternative locations on the ground, in the face of opposition and harassments, was most unsatisfactory.

Consequently the then highway commissioner, John A. Macdonald, took to the air. On April 8, 1931, he arranged with C. H. Birdseye of the Aerotopograph Corporation of Washington to prepare a specially flown and developed air map of portions of the towns of Greenwich and Stamford. The photographs were taken from an altitude of about 1,500 ft. On May 28, 1931, the Department received from this company a set of rather remakable line drawings to a scale of 1 in. = 200 ft, covering a designated area of about 32 sq miles.

These line drawings were made in hard lead pencil on vellum, and were extremely accurate. The geographical positions of control "picture points" were connected by carefully run land traverses for which plane coordinates were computed on the Lambert Conformal Conic Projection. The project engineer at New Canaan, in charge of the location for the Merritt Parkway, conducted the land surveys for this air-photo control under the general direction of Mr. Birdseye, president of the Aerotopograph Corporation and the former chief topographer of the U.S. Geological Survey.

This special air mapping project was one of the very earliest projects of its kind developed by any state highway department. New techniques made possible by this special survey assisted materially in hastening the completion of the most difficult portion of the entire Merritt Parkway.

The detailed and very accurate large-scale maps resulting from this survey were used as a base on which to lay out a number of possible location lines, for each of which capital costs and probable traffic service were estimated. These maps also showed all fence lines, and this information, used in conjunction with recorded deeds, enabled our title searchers to approximate quite closely the boundary lines of the various property holdings.

Maps Aid Appraisal Studies

When a line which seemed to meet best the economic and physical requirements had been developed from, and plotted on, the air survey plan sheets, individual deed plans were prepared from the larger sheets. These deed plans, also to a 200-ft scale, showed with good accuracy the general physical characteristics of each parcel to be taken by the state, and gave within reasonable limits the areas to be acquired. They served as the instruments with which detailed appraisals of rights-of-way costs were made; and with them, preliminary negotiations were opened with owners, and preliminary agreements were made.

Later, course and distance surveys were made, exact takings accurately calculated, and suitable instruments for conveyance were prepared. Thus property owners were fully informed, before any entry was made on their land, as to just where the surveys were to be conducted, what damage would be done to existing physical characteristics, and what the intentions of the State Highway Department were with respect to probable location lines. The detailed surveys were then made only after the owners had been informed of the Department's desire to enter on their lands for survey purposes and after permissions had been granted. A great deal of undesirable and irritating bickering was thus avoided.

In years much more recent than those when the Merritt Parkway was being surveyed, we have embarked on a series of urban highway improvements and have found that the use of aerial survey maps for urban highway planning is an economical and expedient means of establishing locations. The aerial survey maps permit the integration of traffic, topographic, and property controls without the necessity of making instrumental surveys. It has been our experience that this integration is absolutely essential in the planning of urban expressways. Traffic evaluations must be made for alternative improvements. And, in highly developed urban areas where property values are high and existing streets and topography impose definite restrictions, it is necessary to establish the feasibility and practicability of any proposed improvement.

In connection with our planning of major expressway routes, we have contracted for aerial survey maps in the New Haven and Bridgeport urban areas. The specifications of our contract were adapted from those written by the Palisades Interstate Park Commission for the maps produced in connection with the planning of the arterial parkway between the George Washington and Bear Mountain bridges. These specifications appear in the appendix to the paper, "Aerial Surveys Expedite Highway Planning," presented by Samuel Nelson, deputy chief engineer of the Palisades Interstate Park Commission, before the Committee on Road Design at the 31st Annual Convention of the American Association of State Highway Officials in Cincinnati, Ohio, in November 1944.

Large Areas Photographed

Our bid proposal called for two strips, 1 by 6 miles and 1 by 2 miles, in New Haven, and one strip, 1 mile wide by 10 miles long, in Bridgeport. The areas to be covered by the flight were predetermined from the general locations the expressway routes would have to follow in the two urban areas. The contract was awarded in April 1946 for $15,928, or approximately $885 per sq mile. The final ink tracings for the 8 miles in New Haven were received by the Department in November and the 10 miles in Bridgeport were received in December of the same year.

The New Haven flight, covering a T-shaped area, included Route U.S. 1 from the east to the west across the city (Fig. 1), and route U.S. 5 to the north from the city. The Bridgeport flight covered a continuous 10-mile

strip from the east to the west in the general area of route U.S. 1 across the city. The contractor furnished the original photographic negatives, two sets of photographic prints at scales of 1 in. = 1,000 ft and 1 in. = 500 ft, and two photographic index maps to permit the selection of the prints desired to study any part of the project. The five inked tracings for each city are to the scale of 1 in. = 200 ft, and the contour interval is 5 ft.

Elevation of all saddles, tops of summits, bottoms of depressions, railroad and road intersections are shown to the nearest foot. Cultural features are shown in accordance with topographic map procedure as given in Bulletin 788 of the U.S. Geological Survey. All buildings are shown on the map and are plotted in their correct position and orientation. Buildings in which one or more dimensions exceed 100 ft are drawn to scale. All smaller buildings are shown by a 25 × 25-ft symbol.

The Highway Department conducted a traffic survey of New Haven in the fall of 1945. The field data were coded and tabulated the following winter, and the analysis and findings were developed during the past summer and fall. The findings of that study were applied to the aerial survey maps in the establishment of the location and design controls.

Massachusetts Adapts Aerial Photography to Highway Location

E. C. HOUDLETTE

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NO PROBLEM WAS OFFERED in determining the location of the extension of New York's proposed dual express highway to the Lee–Becket, Mass., line, see Fig. 1. This route will enter Massachusetts at the extreme northwest corner of the town of West Stockbridge. Reconnaissance surveys have been made for bypassing the centers of the towns of West Stockbridge, Stockbridge, South and East Lee, and the existing road can be widened from East Lee to the Becket line.

However, the section from the Lee–Becket line to just east of the town of Russell presented an entirely different picture. This portion of the route climbs from El. 655 to 1,775, at the top of Jacob's Ladder, in a distance of about $5^1/_2$ miles. From this point the road descends to El. 810 at the Chester–Becket line and thence follows the narrow valleys of Walker Brook and the Westfield River, walled in on each side by the river, the railroad, and ledge bluffs which rise from 600 to 800 ft. The present roadway in this section is 24 to 30 ft wide, with about 50 of the curves having a radius of 600 ft or less and a total of about 9,000 ft of 6 to 7 percent grade. It is therefore impossible to improve the alignment or widen the existing road. It was imperative that a new location be found.

The only topographic maps of this area that were available were those made by the U. S. Geological Survey in 1886, scale 1:62,500. Considerable time was spent in the office and field with these maps and it appeared that it might be possible to find a line which would meet federal standards south of the present location. This region consists of a series of high hills dotted with very few farms and a large area of woods and rocky terrain.

Costly Reconnaissance Job

Estimates indicated that the average cost for reconnaissance, including field and office work, would be about $1,200 per mile, or a total of about $23,000 for the 19 miles. The time required for two field parties to make the survey was estimated as 6 months. These estimates were based on running a single line and developing a strip about 500 ft wide by 19 miles long. These facts indicate that a fairly definite location would have to be determined in advance of the survey. Such procedure was impossible in this region. A number of lines would have to be developed because of the very rugged terrain; also, it would be necessary to climb from El. 325 just east of the town of Russell, to El. 1,525 in a distance of $5^3/_4$ miles, and the grades of the proposed road were not to exceed 5

Fig. 1. COST OF RECONNAISSANCE SURVEYS for relocating U. S. Route 20 is reduced from estimated 10 to 12 dollars per acre to 86 cents per acre, including field work and plotting. Length of new dual-type express highway is 19.3 miles, 4.4 miles less than present route. Rectangles show areas covered by several aerial topographical maps required to complete survey.

percent. We had heard about aerial topographic maps being used by the State of New York for highway studies and decided this would be an ideal area for such a map.

The Aero Service Corp. furnished the department with a series of strip maps 6,000 ft wide, scale 1 in. = 200 ft, with 5-ft contours for the entire length of 20.5 miles, for $12,895, or $629 per mile. On this basis the cost per acre was 86 cents compared with an estimated cost for a reconnaissance survey of $10 to $12 per acre, including field work and plotting. The contract was signed October 17, 1944, and work was commenced as soon as flying conditions would permit.

Seven topographic sheets varying in length from 5 to 9 ft by 2.5 ft wide were required to complete the survey. All the cultural features were shown in correct horizontal position. Buildings in which one or more dimensions exceeded 100 ft were drawn to scale. All smaller buildings were shown 25×25 ft.

As an aid to orientation on the map, all stone walls and fences which were visible in the photographs and not adjacent to roads were shown on the map in areas that lacked other planometric features. Trails were shown as a single dotted line representing the center. Minor roads were shown by a double-dotted line 30 ft wide, and main roads 50 ft wide. Transmission lines on private rights-of-way were shown.

The outlines of wooded areas were carefully and accurately delineated. Grid lines were shown on the tracings at 1,000-ft intervals, conforming to the established Massachusetts grid system for the area. The field work performed by the contractor consisted of expanding the basic control established by the Massachusetts Geodetic Survey. This available control consisted of triangulation and/or traverse, and all such stations that fell within the limits of the map were shown in their correct positions.

Accuracy of Maps Checked

The department made two test profiles of each sheet, as rapidly as possible after receipt from the contractor, by running a profile and comparing the elevations with those shown on the map sheet. All elevations interpolated from the map were within one-half the contour interval (2.5 ft).

The contractor delivered one set of contact prints, scale 1 in. = 100 ft, and one set of prints, scale 1 in. = 500 ft. These prints had sufficient overlap for stereoscopic study. The contractor also furnished one copy of a photographic index map at a scale of 1 in. = 3,000 ft to readily permit the selection of the prints desired to study any part of the project. A mosaic map of the same area, based on the Massachusetts Geodetic Survey's horizontal control, was prepared. Two black-and-white photographic copies of the original mosaic were furnished. These prints had a semi-matte finish and were assembled on cloth in lengths of about 72 in. The scale was 1 in. = 500 ft.

Shown in Fig. 1 is a U.S. Geological map on which existing Route 20 appears as a solid heavy line from the New York line to a point north of the city of Springfield. The proposed new location is shown in heavy dashed lines. The areas of the aerial topographic strips are shown in outline and are copied from the map that was prepared for the contract and included in the proposal.

Alignment and profile studies were started as soon as the first preliminary sheet was received from the contractor. These studies showed that it was feasible to construct a modern dual-type express highway in this region with only 15 curves with radii in excess of 2,500 ft and with a maximum grade of 5 percent. The length of the new location is 19.3 miles compared with 23.7 miles along the present route.

The aerial topographic maps are based on the Massachusetts system of rectangular coordinates so it is possible to compute the exact center line of location for the use of survey parties. This line can then be run out and tied in.

Grading Contract Estimates

These aerial maps have simply been used in place of the usual ground reconnaissance survey to determine the location of a line. When the proposed route is constructed and preliminary sections have been taken, a comparison will be made with sections plotted from the aerial topographic maps to determine whether aerial topographic maps can be used to estimate quantities for grading contracts.

The line from Russell to a point north of Springfield offers no real difficulties as it crosses a rather flat region north of the city of Westfield, through the notch in the Holyoke Range and thence through a sparsely settled area between the centers of Chicopee and Springfield.

Chapter 215, Acts of 1933, authorized the Department of Public Works to confer with the director of the U.S Geological Survey, to cooperate in the preparation of a contour topographic survey and map of the commonwealth. The expenditure by the commonwealth shall equal the amount expended for such work by the United States of America but in no event shall the expenditure of the commonwealth exceed $50,000 in any one year. At the time of the passage of this act it was estimated that it would take 10 years to complete the map, but the war interfered. To date the field work has been completed and 90 percent of the maps have been published.

Under this cooperative plan the Department received copies of the contact prints covering the entire commonwealth. These prints are on a scale of 1:24,000 and 1:36,000 with the usual 60 percent overlap. Although the scale is too small for detailed studies, the prints have been invaluable in fixing approximate locations in areas where the terrain is fairly open and sparsely settled.

In the past 16 years the Department has let contracts to furnish prints and mosaics for the location or relocation of the following routes:

1.	Circumferential highway .	Route 128
2.	Worcester turnpike . . .	Route 9
3.	Taunton to Plymouth . .	Route 141
4.	Newburyport turnpike .	Route 1
5.	North and south routes along Cape Cod Canal .	
6.	Lancaster to Westminster.	Route 2
7.	Bypass of Lee and Stockbridge	Route 20

The average scale of the prints was 1 in. = 600 ft with the usual 60 percent overlap. They were used with the stereoscope to determine the approximate location of the line as a basis for a reconnaissance survey. The prints were also invaluable for studies of layouts at junctions for traffic interchange.

Advantages of Aerial Photography

Although Massachusetts is now covered by excellent topographic maps, large-scale up-to-date aerial photographs of proposed highway locations are of value in two ways: (1) To help ensure the selection of the optimum route and (2) to reduce the cost of engineering. Among the advantages of aerial photographs, the following specific features are noteworthy:

1. The photograph gives a complete inventory of surface features, by means of which the engineer can readily determine present land utilization, such as whether the built-up sections are residential or industrial,

(*Continued on page 14*)

Engineers' Notebook

Simplified Formula Is Based on Effect of Plastic Flow in Reinforced Concrete

BORIS W. BOGUSLAVSKY, ASSOC. M. ASCE

Head, Department of Civil Engineering, The University of Akron, Akron, Ohio

AN AXIAL LOAD placed on a reinforced concrete column produces immediate stresses in the steel and concrete which can be correctly calculated by the elastic theory, that is, by assuming that concrete is an elastic material and that the stresses in the two materials are to each other as their moduli of elasticity.

It is known, however, that under a steady load plain concrete slowly undergoes a plastic deformation in addition to the initial elastic deformation. If the concrete is reinforced and if the column is to deform as a unit, the magnitude of the plastic deformation under the same initial unit stress cannot be as great as in the plain material because the plastic deformation of the concrete must be accompanied by an equal elastic deformation of the reinforcement. Since this additional elastic shortening of the reinforcement cannot occur without a corresponding increase in the steel stress, it follows that, under a constant load, the plastic flow of concrete causes a partial shift of the load from the concrete to the steel portion of the cross section.

An expression relating the stresses in the concrete at the beginning and at the end of the period of plastic flow has been derived by Glanville (Sutherland and Reese, *Reinforced Concrete Design*, pages 110–111). It reads as follows:

$$f_c = \frac{f_{co}}{e^{\frac{c}{A_c/A_s E_s + 1/E_c}}} \quad . \quad . \quad . \quad (1)$$

where

c = the plastic deformation of a unit length of plain concrete under a unit stress

f_{co} = the initial concrete stress calculated by the elastic theory

f_c = the stress in the concrete at the completion of the plastic deformation

A_c, A_s = the areas of the concrete and steel portions of the cross-section, respectively

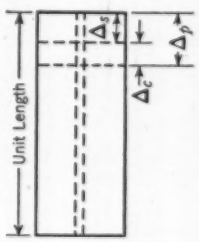
E_c, E_s = the moduli of elasticity of concrete and steel, respectively

e = the base of the natural system of logarithms = 2.718

Glanville's is one rare formula in the theory of reinforced concrete design whose derivation is usually disconcerting to an engineering student (and sometimes to an engineering teacher) and whose application is hampered by an awkward exponent necessitating the use of logarithms in its solution. As an escape from these two inconveniences the writer wishes to present a simpler, and more simply derived, expression which, though approximate, gives results differing but little from those obtained by Eq. 1.

Assuming the two materials making up a reinforced concrete column of unit length to act independently of each other, consider the deformation of the column as taking place in three simultaneous steps:

(1) Δ_p = the plastic shortening of the concrete under a stress gradually decreasing from f_{co} to f_c
(2) Δ_c = the elastic expansion of the concrete caused by the decrease of the compressive stress from f_{co} to f_c
(3) Δ_s = the elastic shortening of the reinforcement caused by the increase of the steel stress from f_{so} to f_s



where

f_{so} = the initial stress in the steel calcu ated by the elastic theory

f_s = the stress in the steel at the completion of the plastic deformation in the concrete

For the column to deform as a unit the following condition must exist:

$$\Delta_p - \Delta_c = \Delta_s \quad . \quad . \quad . \quad . \quad (a)$$

$$\text{But } \Delta_c = \frac{f_{co} - f_c}{E_c} \quad . \quad . \quad . \quad . \quad (b)$$

$$\text{and } \Delta_s = \frac{f_s - f_{so}}{E_s} \quad . \quad . \quad . \quad . \quad . \quad (c)$$

To find Δ_p an assumption is made that Δ_p is proportional to the mean of the compressive stresses acting in the concrete at the beginning and at the end of the plastic deformation, that is, that

$$\Delta_p = \frac{f_{co} + f_c}{2}(c) \quad . \quad . \quad . \quad (d)$$

Substitution in Eq. (a) from Eqs. (b), (c), and (d) gives

$$\frac{f_{co} + f_c}{2}(c) - \frac{f_{co} - f_c}{E_c} = \frac{f_s - f_{so}}{E_s} \quad . \quad . \quad . \quad . \quad (e)$$

Now the increase in load carried by the steel must be equal to the decrease in load carried by the concrete, that is,

$$A_s(f_s - f_{so}) = A_c(f_{co} - f_c) \quad . \quad . \quad (f)$$

Replacing $(f_s - f_{so})$ in Eq. (e) by $\frac{A_c}{A_s}(f_{co} - f_c)$ gives

$$\frac{f_{co} + f_c}{2}(c) - \frac{f_{co} - f_c}{E_c} = \frac{A_c}{A_s E_s}(f_{co} - f_c) \quad . \quad . \quad . \quad . \quad (g)$$

which finally results in the new formula,

$$f_c = f_{co}\frac{A_c + A_s(n - E_s c/2)}{A_c + A_s(n + E_s c/2)} \quad . \quad (2)$$

(*Continued on page 30*)

...THE READERS Write

Computing Vertical Curve Simplified

DEAR SIR: In the opinion of the writer a more practical approach to the problem of computing a vertical curve than that presented by John A. Oakey, in the October issue of CIVIL ENGINEERING, is presented here.

Problem: Given, a minus 2 percent highway grade intersecting a plus 4 percent grade at station 563 + 00.0. The elevation of the grade intersection is 569.30. A 1,000-ft vertical curve length has been selected. Compute the grade elevations of points at 50-ft intervals on the 1,000-ft parabolic vertical curve used as a transition from the minus grade to the plus grade.

Solution: 1. Compute the tangent grade for each point at which an elevation is required on the vertical curve.

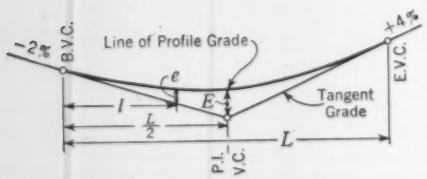


FIG. 1. TANGENT GRADE AND Vertical Curve Data Diagram.

2. Compute the external distance or distance from tangent-grade intersection to the mid-point on the vertical curve by the formula, $E = \frac{L \times A}{8}$, in which E is the external distance, L is the length of the vertical curves in 100-ft stations, and A is the algebraic difference in grades.

3. Determine the station of the beginning and the end of the vertical curve by the subtraction and the addition of one-half the value of L from and to the station of the tangent grade intersection.

4. Compute the intermediate distance from points on tangent grades to the vertical curve for required stations, using the parabolic curve formula $\left(\frac{l}{L/2}\right)^2 E = e$, in which l is the distance from either the beginning or the end station of the vertical curve to the station for which the intermediate distance is desired. The value of l varies from 0 to one-half the length of the vertical curve; L is equal to the length of the vertical curve; E is the external distance computed by the solution explained in Step No. 2; and e is the required distance between the tangent elevation and the vertical curve elevation for the point for which the computation is made.

5. Add or subtract the value of e from the tangent grade elevation for the given station, add if the vertical curve is concave or subtract if the curve is convex, and the remaining value is the correct center-line elevation for the given point on the vertical curve.

A convenient method of tabulating this computation is shown in Table I.

N. W. PETTIJOHN
Registered Civil Engineer

Portland, Ore.

TABLE I. TABULATION USEFUL IN COMPUTING VERTICAL CURVE

STATION	V.C. POINTS	GRADE DATA	TANGENT GRADE EL.	V.C. CORRECTION	PROFILE
557			581.30	"e"	581.30
+50			580.30		580.30
558	B.V.C.		579.30	00	579.30
+50			578.30	+0.08	578.38
559			577.30	+0.30	577.60
+50			576.30	+0.68	576.98
560		−2% Grade	575.30	+1.20	576.50
+50			574.30	+1.88	576.18
561			573.30	+2.70	576.00
+50			572.30	+3.68	575.98
562			571.30	+4.80	576.10
+50			570.30	+6.08	576.38
563	P.I V.C.	——	569.30	+7.50	576.80
+50			571.30	+6.08	577.38
564			573.30	+4.80	578.10
+50			575.30	+3.68	578.98
565		+4% Grade	577.30	+2.70	580.00
+50			579.30	+1.88	581.18
566			581.30	+1.20	582.50
+50			583.30	+0.68	583.98
567			585.30	+0.30	585.60
+50			587.30	+0.08	587.38
568	E.V.C.		589.30	00	589.30
+50			591.30		591.30
569			593.30		593.30

Plea for Peace Comes From a Civil Engineer

TO THE EDITOR: As a *civil* engineer I wish to challenge the ideas and the policy advocated by Maj. Gen. H. S. Aurand in the leading article of the November issue, entitled "Times Call for Mobilization of Engineers and Scientists." He writes: "The survival of our democratic idea, our concept of a Bill of Rights, and our way of life no longer rest upon the military forces, but upon the engineer's assistance and insistence in the solution of military engineering problems."

Our way of life *never* rested upon the military forces of our nation. On the contrary, the very heart and meaning of the democratic idea is destroyed by the methods of regimentation and coercion inherent in the military way of life. Preparation for war inevitably leads to war. Why do we contribute millions of dollars to the United Nations organization for the preservation of peace, and at the same time continue the immoral and anti-Christian *acts* of preparation for war as proposed in this article, and by producing atom bombs, jet planes, rockets, etc., etc.?

The way to prepare for peace *now* is to join with all the other great nations in the necessary *action* for disarmament in good faith. The preparation for World War III, due to fear of Russia, is treason to the idea of the United Nations and betrays the hopes of the millions of ordinary people who hate war and have to pay the price of war in "blood, sweat, and tears."

All *civil* engineers should devote their energies and capacities *exclusively* to the peaceful development of the powers and resources of our country for the welfare of our citizens—"using the great sources of power in nature for the use and convenience of man." It is a most astounding perversion of the abilities of engineers and scientists to divert them to this proposed collaboration with Army and Navy in preparation for mass-murder and destruction. "Thou shalt not kill" should apply to nations as well as individuals. The lie that preparation for war in the year 1946 is necessary for self-preservation should be exposed and denounced. There is not the slightest danger that Russia or any other nation will attack the United States. The military claim that the best defense is offense must be recognized as a very obvious excuse for aggression.

The only sure road to peace is world government under law, upheld by courts of justice. This requires the abandonment of the idea of national sovereignty in international relations.

Let *civil* engineers devote themselves to constructive activities promoting the well-being of the men and women of our country, and thus contribute most to the welfare of the people of the whole world.

J. PAUL J. WILLIAMS, M. ASCE

New York, N.Y.

Expansion of ASCE Suggested by Juniors

TO THE EDITOR: During the past year, in our capacities as Junior Aides to the president and secretary of the Mid-South Section, we have for the first time had brought home to us the problems confronting the engineering profession and the opportunity that exists for the ASCE to render real service to the profession. Our attention has been especially focused on the question of whether the ASCE should continue as a comparatively static "honor" society, with the primary function of recognizing the attainments of the top men of the profession, or whether it should become a progressive "service" society, dedicated to the purpose of promoting the welfare of the profession as a whole and of the public served by the profession.

Prior to our appointment as Junior Aides, we were among the many in the Society who had an all too vague understanding of just what the ASCE does for its members. Since our introduction into the inner workings of the Society, we have been pleased to learn that some progress has been made in converting it into a "service" organization. In recent years the Society has expanded its activities to include action in such matters as collective bargaining, salary schedules, public relations, and cooperation with other engineering societies.

In spite of this encouraging trend, there is much evidence of a need for further drastic action to convert the ASCE into a truly effective "service" society. The fact that on several occasions, in recent months, labor union activities have forced professional engineers to face the alternative of joining a union of non-professional workers or of losing their jobs and, in some cases, have deprived engineer employees and employers of their means of livelihood is proof that the Society's efforts in this field have been far too feeble. Further, the very fact that it was necessary for representatives of the ASCE and other engineering societies to call the attention of our lawmakers to the desirability of including provisions for engineering research in the Kilgore-Magnuson Bill on scientific research shows that the engineering profession as a whole has been far from successful in making the general public aware of its place in the affairs of the country.

As we see it, one of the prime requisites for putting the Society in a position to combat such a state of affairs is to build up the membership until the ASCE is a large, effective organization, representing the entire civil engineering profession instead of approximately one-fourth of it. Such an organization would bear considerable weight in seeking recognition of engineering as a profession, and would find its recommendations valued and sought after in community matters requiring unbiased engineering opinion. A strong Society should have little trouble in convincing the labor union of its ability to handle employer-employee relationships within the profession.

To attain the goal of a large membership, we would suggest the following course of action:

1. The present membership should go all out in support of policies designed to show other engineers that the ASCE, in addition to its excellent technical program, really has something to offer them in the way of improving their professional and economic status. The other 60,000 civil engineers would then want to become members of the ASCE.

2. The structure of membership grades and the Society's qualification requirements should be revised to broaden the base for membership. Upon graduation from college, the young engineer should go through a four-year "proving" period or "internship" as a Junior Member, after which he should automatically become a full Member if he continues in the engineering profession. Elimination of the distinction between the present Associate Member and Member is inherent in this plan. The general scheme of qualification for membership in the Society should tie in with the present requirements for registration as professional engineers. Such an arrangement would tend to pave the way for uniting the ASCE and the civil engineering profession. The Junior Member should have full corporate rights, and his dues should be a bare minimum to encourage graduates to join the Society.

3. An active but dignified campaign for new members should be inaugurated and continued. The easiest way of getting the engineer into the Society is to begin when he is still in school or during the first four years after his graduation. An important aid in accomplishing this would be to have all civil engineering teachers members of the Society. The Faculty Adviser's efforts to familiarize the student with the Society are very important, and for this reason every encouragement should be given him even to the extent of remuneration. Every effort should also be made to sell the Society to the older qualified engineer. In the past, there seems to have been reticence in approaching engineers on the subject of joining the Society. This mental reservation should be discarded.

An intensification of public-relation activities is one of the most important needs of the Society. These activities should be designed to inform the public of the importance of the engineer and the part he plays in everyday life. An effective means of accomplishing this aim would be to promote a popular engineering magazine and to encourage the publication of non-technical engineering articles in existing magazines of national circulation. Similarly, motion pictures and radio would offer additional mediums for bringing the engineer before the public.

The Society can count on the younger members for the fullest cooperation in making the ASCE a "service" organization. We are convinced that the opportunity to make our Society of real service to the profession and to the public is limited only by the imagination of its members and their capacity for work.

EDWARD B. MADDEN, Jun. ASCE
and
LOUIS E. BONA, Jun. ASCE

Little Rock, Ark.

Veterans Found to Be Excellent Students

TO THE EDITOR: When I returned to my position as assistant professor of civil engineering at the Agricultural and Mechanical College of Texas a year ago, I was pleasantly surprised by the eagerness for study shown by postwar students.

TABLE I. DIFFERENCES IN PREWAR AND POSTWAR COLLEGE GRADES

	GRADES				
	(Excellent) A	(Good) B	(Fair) C	(Poor) D	(Fail) F
Prewar	16.2%	35.8%	33.1%	9.2%	5.7%
Postwar	35.7%	55.5%	8.8%	0	0

Difference in my grades for prewar and postwar periods are illustrated in Table I.

Prewar grades were based on 1,004 final grades from September 1939 to July

1943. Postwar grades were based on 182 final grades during 1946, 76 percent of the students being returning veterans studying under the G. I. Bill of Rights. No attempt was made to separate grades made by the returning veterans from those made by younger students who had not been in military service, as little difference was apparent in such grades.

A study of the table indicates a marked improvement in postwar grades over prewar grades, the absence of grades in the lower brackets of D and F being of particular importance. Possibly such a marked improvement in grades will not be made by large numbers of students over a long period of time, but I am convinced that the returning G.I. is a better student than he was before he went to war.

E. L. HARRINGTON, Assoc. M. ASCE
Asst. Prof. of Civil Eng.
Texas A. & M. College

College Station, Tex.

"Reverse-Arch" Dam Called No Novelty

DEAR SIR: The cartoon on page 563 of the December issue interested me, as I am sure it did many other readers. The "reverse-arch" dam is not quite as novel, however, as many a reader might suppose. A widely known engineering educator and member of the Society—Prof. B. J. Lambert, of the State University of Iowa—demonstrated some years ago that such a plan might be preferred in some circumstances. I refer to his article, "Gravity Dams Arched Downstream," which appeared in Vol. 96 of TRANSACTIONS.

Let me add that I appreciate the evident efforts which are currently being made to increase the value and appeal of our magazine.

R. A. KAMPMEIER, M. ASCE
Chattanooga, Tenn.

Opportunity for Study in European Schools Cited

TO THE EDITOR: Now that it is again possible to travel and study in Europe, young engineers may be interested in a brief comment on present conditions. Although I was an M.I.T. Traveling Fellow (1929–1931) rather than a Freeman Scholar, my fellowship was arranged as a result of Dr. Freeman's influence, and I have since had considerable contact with and interest in the Freeman alumni. During the fifteen years since the time of my European study, I have revisited many of the laboratories on three different occasions. Since my last inspection trip was completed this fall, certain of my findings in connection with future scholarships may be timely.

There are, at present, three European institutions which are of at least as high a caliber as those at which a number of scholars previously studied. These are the Eidgenossische Technische Hochschule at Zurich; the University and the Neyrpic Laboratory at Grenoble; and the City and Guilds College in London. Both Prof. E. Meyer-Peter, in civil engineering, and Prof. J. Ackeret, in mechanical engineering, have very active research laboratories at the Zurich Hochschule, and several American graduate students are already there. Prof. P. Danel, of Grenoble, who divides his time between the University and the Neyrpic plants, has perhaps the largest research staff of its kind on the continent, and his laboratory is an extremely busy one. Professor C. M. White, of London, whom I had previously known only through his excellent writings, proved to have both a keen understanding of many different aspects of fluid motion and a most productive experimental laboratory.

The writer's experience has been that a scholar or fellow derives optimum benefit from foreign travel when he is able to spend several months at each of a few institutions rather than several days at each of a great many. It is therefore suggested that the lack of many active laboratories in Europe at the present time should no longer be considered a reason for restricting Freeman Scholars to travel in this country, for the three institutions discussed here would easily provide ample material to occupy a year of study abroad, while a degree from any one of them would be well worth seeking.

HUNTER ROUSE, M. ASCE
Director, Iowa Inst. of Hydraulic Research

Iowa City, Iowa

Girder-Type Sections in Bridge Design Questioned

TO THE EDITOR: The writer's absence from the country has prevented an earlier reply to Dr. Steinman's discussion, in the October issue, of his article, "Lessons in Bridge Design Taught by Aerodynamic Studies," in the August issue. There is abundant evidence at hand refuting Dr. Steinman's repeated statement to the effect that, "In general, for any truss-type section there is an equivalent (shallower) girder-type section that will show the same aerodynamic characteristics." The conclusions drawn from this reasoning represent a dangerous oversimplification of this most complex problem.

It is the writer's belief that the dynamic properties of a suspension bridge section cannot be reliably predicted from the results of static tests alone and that sole reliance on such data can lead to potentially dangerous design. Although it is undoubtedly true that the characteristics of the lift and moment graph have *some* bearing on the problem, there is also ample evidence that at least two other most important sources of excitation are present in many cases.

In the opinion of those most closely associated with this new field of investigation, there is in general no truss section that can be considered the *aerodynamic equivalent* of a solid web girder of any practical form. Dr. Steinman will have to produce more reliably substantiated data than any that have yet appeared in print before such claims can be taken seriously.

It was the writer's privilege to participate recently in certain experiments in a foreign laboratory, where it was dramatically demonstrated that exceedingly small changes, having no appreciable effect on the static characteristics of the section, altered a dynamically satisfactory structure in a decidedly dangerous manner. Likewise, there are on record in our laboratory at the university numerous similar cases.

It is unfortunate that the times have prevented full investigation of this most interesting problem, and the writer hopes in the near future to be able to publish full data and conclusions resulting from the experimental work under his direction. It is far too early, in view of the rudimentary character of much of the experimental evidence presently available, to indulge in positive statements regarding the merits of various sections. But the writer is convinced that, considering the current state of engineering information, it would be most unscientific to remove the solid plate girder from the dog house where it at the moment most properly belongs. It is true that there are in print many misleading and unfounded conclusions, which in most cases completely lack any satisfactory laboratory proof.

One finds no difficulty in subscribing to Dr. Steinman's enthusiasm for the girder type of section and every effort should be made to return it to favor. But the fact remains that no conclusive proof has yet been offered that aerodynamic stability can be achieved in the range of practical d/b ratios without recourse to stays or similar undesirable devices.

F. B. FARQUHARSON, M. ASCE
Director, Engineering Experiment Station, Univ. of Washington

Seattle, Wash.

SOCIETY NEWS

E. M. Hastings Stresses Objectives at Inaugural

Vote for Juniors, Increase in Dues, Commended for Early Action by New President

ENFRANCHISEMENT OF JUNIORS and a constitutional amendment ballot on the question of an increase in ASCE dues were commended to the corporate members "for immediate and earnest consideration and prompt action" by E. M. Hastings upon the occasion of his inauguration as president of the American Society of Civil Engineers.

Departing somewhat from tradition in delivering a brief address at the Society's 49th Annual Meeting in the Hotel Commodore, New York, January 15, Mr. Hastings expressed "the utmost confidence that the corporate members, who enjoy all the privileges of our Society, will manifest wisdom and fairness in rising to the responsibilities entailed by these decisions."

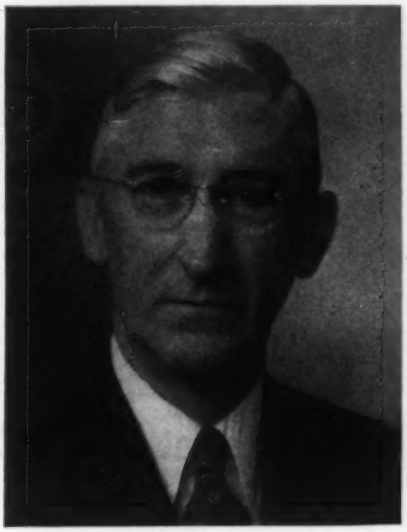
The decisions, which he termed "all-important," affect "the very life and growth of the Society," and are to be expected during this year in which he heads the Society, Mr. Hastings said in explaining the fact that he felt called upon to discuss them with the membership at the outset of his term of office.

He emphasized the fact that the momentum for the constitutional amendment ballots required both for giving the Juniors the vote and for an increase in dues, the latter ($5 per year for corporate members and $2.50 per year for Juniors) recommended by the Board of Direction at its fall meeting in Kansas City in October, must emanate "from the Local Sections and the present corporate members."

"I am confident," Mr. Hastings declared, "that the momentum for a constitutional amendment regarding dues will be forthcoming—and soon; that today's members of our profession will be no less farsighted than earlier generations of Society members, who not only provided us with an ever-growing and ever-more-useful Society, but also created the modest reserves upon which we now are drawing pending the operation of our democratic process of constitutional amendment to provide dues with which we can pay our own way. I am confident that our professional pride today will be no less than that of the men we succeed in the profession they created and enhanced, and that we too shall do our duty by future generations of civil engineers."

Those who know Mr. Hastings and are familiar with the sincere zeal with which he prosecuted his work among young men as chairman of the ASCE Committee on Student Affairs for seven years, were not surprised when they heard him say he accords "the number one position on the list of my aims and hopes" to the question of giving the Juniors the vote in Society affairs.

"New ideas are best served by new blood," President Hastings declared.



EDGAR M. HASTINGS,
President for 1947

"Our organization needs some. For some time, the question of membership grade changes has been discussed, and varying opinions have been forthcoming on such questions as what qualifications shall be required for various grades of membership, if there is to be any reclassification. Concurrent with this discussion, and in my opinion of more immediate importance, consideration has been given to the question of whether Junior members shall be accorded the privilege of voting. I am particularly concerned with this latter proposal—to give Junior members greater voice and higher standing among our membership.

"For a long time I have been convinced that a man old enough to vote for city, state and federal officers is old enough to vote for the officers of his professional society. In my opinion, the older members of his profession should be the most willing to accord him the same privilege within, as he enjoys outside of, the profession of his choice.

"Further, our own particular times, and the program of expansion now under way within the Society, call for immediate action to remedy this condition, under which approximately one-third of our total membership has no voice whatsoever in Society affairs. In my opinion, the decision as to whether Juniors shall be franchised cannot be deferred until such time as we finally determine all the details surrounding the much-more-involved and controversial subject of membership reclassification. That decision should be made without delay.

"It is obvious that the question of membership reclassification requires time. The question of giving the Juniors the right to vote requires action."

Each year in the issue of CIVIL ENGINEERING immediately following the Annual Meeting, there appears a biographical sketch of the new president of ASCE. This year, the biographical material concerning Mr. Hastings is here combined with the foregoing inaugural statements he made, in order that the membership may have an opportunity to know a little more about the man who heads the Society and who commences his term of office with the aims and hopes Mr. Hastings has enunciated.

Born in Lutherville, Md., May 5, 1882, and educated in the public schools of Baltimore and the Baltimore City College and Baltimore Polytechnic Institute, Mr. Hastings has devoted his entire professional life to the field of railroad engineering. Starting with the Baltimore and Ohio Railroad Co., he very early, in December 1903, moved to the Richmond, Fredericksburg and Potomac Railroad Co., and through various engineering positions, worked his way up to the position of chief engineer in 1922.

In that position, which he still holds, he has had charge of the work entailed in continuously improving the system, and he has directed all of the R.F. & P.'s engineering matters in connection with valuation under the Federal Valuation Act and Interstate Commerce Commission orders.

In Society affairs, Mr. Hastings has been extremely active, despite the demands made upon his time by his business. He became an Associate Member in 1910 and a Member in 1922. For many years he was contact member for

the Virginia Section of the Society to the Virginia Military Institute. In tribute to his work with the young men of VMI, he was made an honorary member of the Class of 1918. First as a member, and later as chairman for seven years, Mr. Hastings carried on effective work on the Society's Committee on Student Chapters.

He left that chairmanship when he became Vice-President from Zone II, serving in 1943 and 1944 on the Board of Direction of the Society. During his service on the Board, he was chairman of the Committee on Technical Procedure and chairman of the Committee on Division Activities. He also was a member of the executive committee of the Engineering Economics Division of the Society. For two years, he was president of the Virginia Section, ASCE, and has always been interested in the Local Section and taken a very active part in its affairs.

Since 1912, Mr. Hastings has been very actively interested in the American Railway Engineering Association, in which he has had and now has important committee assignments. He served as director 1932–1935, vice-president 1937–1939, president 1939–1940, and is at present a member of the board of direction as past-president. Also he has long been interested in the affairs of the American Association of Railroads and is a past chairman of its Engineering Division. He is a member of the Committee on Automatic Signals and Train Control, of the Joint Committee on the Relation of Rolling Stock and Track, and of the Signal Section. He is the representative of the Association of American Railroads on the Standards Council of the American Standards Association.

INCOMING PRESIDENT HASTINGS is congratulated on his inaugural address by two ASCE Juniors, J. A. Blacock (shaking hands) and George E. Gyongya, following opening session of Annual Meeting.

Other organizations in which Mr. Hastings holds membership are: the American Society for Testing Materials, the American Railway Bridge and Building Association, the Roadmasters' and Maintenance of Way Association of America, the National Society of Professional Engineers, the Central Virginia Engineers' Club (past-president), the Engineers' Club of Hampton Roads, and the Engineers' Club of the Virginia Peninsula.

In addition to his other work, Mr. Hastings has taken an interest in the civic welfare of the City of Richmond, having served as chairman of the Board of Zoning Appeals and of the City Planning Commission, which developed a long-range plan for the future development of the city. During the war period, his work with the railroad company became so heavy that he was forced to resign these activities. However he is still a member of the Virginia Chamber of Commerce, the Richmond Chamber of Commerce, and the Lions Club. He has always been very active in the work of the Methodist Church.

Mrs. Hastings is well known to many of the ladies of the Society. There are two sons, E. M., Jr., who is with the Department of Signals and Communications of the Chesapeake & Ohio Railway, and David C., Jun. ASCE, who has recently returned from Europe as a major in the Transportation Corps of the Military Railway Service, having formerly been assistant supervisor of track with the Pennsylvania Railroad, and since his return, supervisor of track.

New Officers Installed at New York Meeting

Ninety-Fourth Annual Meeting Features Sessions of Ten Technical Divisions

A NEW PRESIDENT, Edgar M. Hastings of Richmond, Va., two Vice-Presidents and seven Directors were installed in office at the January 15 session of the American Society of Civil Engineers. This business meeting opened a four-day convention at the Hotel Commodore in New York City. An extensive program included technical sessions, field trips, college reunions, and numerous social affairs. Attendance records indicate that over 2,300 took part in the activities.

On Wednesday morning, January 15, in addition to the installation of officers, honorary memberships and prizes were awarded. Such awards are the tangible means used by ASCE to recognize outstanding accomplishments in technical and professional fields. It was therefore of interest to note that recipients were drawn from many localities—one from Brazil was able to be present.

New officers installed were:

President, Edgar M. Hastings, chief engineer, Richmond, Fredericksburg and Potomac Railroad, Richmond, Va.

Vice-President, Zone II, Gail A. Hathaway, special assistant, Chief of Engineers, Washington, D.C.

Vice-President, Zone III, Ralph B. Wiley, head, Department of Civil Engineering, Purdue University, West Lafayette, Ind.

Director, District 3, Harland C. Woods, U.S. Engineers, Buffalo, N.Y.

Director, District 5, Roy W. Crum, director, Highway Research Board, Washington, D.C.

Director, District 7, Lewis M. Gram, retired head, Department of Civil Engineering, University of Michigan, Ann Arbor, Mich.

Director, District 8, Samuel A. Greeley, consulting engineer, Chicago, Ill.

Director, District 9, Daniel V. Terrell, dean, College of Engineering, University of Kentucky, Lexington, Ky.

Director, District 12, Walden L. Malony, consulting engineer, Spokane, Wash.

Director, District 16, David L. Erickson, city engineer, Lincoln, Nebr.

Honorary membership was awarded to the following:

A. W. K. Billings, recently retired as president, Brazilian Traction, Light and Power Co., Rio de Janeiro, Brazil.

Charles B. Burdick, consulting engineer, Chicago, Ill.

Albert P. Greensfelder, contractor, St. Louis, Mo.

LeRoy K. Sherman, consulting engineer, Chicago, Ill.

Eight members were honored for contributing outstanding papers by the award of prizes and medals. They were:

Normal Medal, Karl Terzaghi, professor of the practice of civil engineering, Harvard Graduate School of Engineering, Cambridge, Mass.

J. James R. Croes Medal, Gail A. Hathaway, special assistant to the Chief of Engineers, Washington, D.C.

Thomas Fitch Rowland Prize, James B. Hayes, chief engineer, Commission of Palestine Surveys, New York, N.Y.

James Laurie Prize, Lewis A. Schmidt, Jr., consulting engineer, Chattanooga.

Arthur M. Wellington Prize, James H. Stratton, Colonel, Corps of Engineers, supervising engineer for the Panama Canal, Panama Canal Zone.

TWO ASCE PRESIDENTS occupy rostrum as retiring President Horner presents gavel to incoming President Hastings.

NEW DIRECTORS SNAPPED after induction into office are, left to right: Walden L. Malony, Director, District 12; Ralph B. Wiley, Vice-President, Zone III; Daniel V. Terrell, Director, District 9; Roy W. Crum, Director, District 5; Samuel A. Greeley, Director, District 8; David L. Erickson, Director, District 16; Harland C. Woods, Director, District 3; Lewis M. Gram, Director, District 7; Gail A. Hathaway, Vice-President, Zone II.

DELEGATION FROM VIRGINIA Military Institute presents its honorary alumnus, President Hastings, with etching of VMI campus, at Student Chapter Conference. V.M.I. Student Chapter members are, left to right: Richard Overmeyer, Albert Balling, Robert Watt, and Charles T. Metcalf.

FOUR PRIZE WINNERS have front seats at annual meeting. Left to right: L. A. Schmidt, Jr., James Laurie Prize; C. O. Clark, Collingwood Prize for Juniors; James B. Hayes, Thomas Fitch Rowland Prize; and Gail A. Hathaway, J. James R. Croes Medal.

Collingwood Prize for Juniors, C. O. Clark, in charge of hydraulic section, U.S. Engineer Office, Norfolk, Va.

J. C. Stevens Award, John S. McNown, research engineer, Institute of Hydraulic Research, University of Iowa, Iowa City, Iowa.

Construction Engineering Prize, George K. Leonard, project manager, Watauga and South Holston Dams, TVA.

The Wednesday luncheon, in the Grand Ballroom of the Commodore, will be remembered for the address of E. O. Shreve, vice-president of the General Electric Co. Mr. Shreve said, in part:

"If the labor leaders are sincere, and I believe they are, in their statements that they have the welfare of all people in mind, as well as their members, they have the opportunity of making a tremendous contribution to the welfare of the nation by refraining from making additional demands for at least a year. This would give business and industry an opportunity to become stabilized—to increase production and efficiency—to realize lower costs—all resulting in lower prices. . . . I firmly believe we can have the kind of government and country we want, but we cannot have it by sitting on the sidelines with an attitude of "let George do it."

A conference of Student Chapters, sponsored by the Chapters in the Metropolitan area, was held on Wednesday afternoon, concurrent with Technical Division session. Speakers emphasized the opportunities to be seized by engineers while delegates from several Chapters discussed activities of their Chapters. Students attended many of the technical meetings and social events. A more detailed write-up of the conference appears on page 100.

On Wednesday night the dinner and dance, in the Commodore's Grand Ballroom, was an outstanding affair. Excellent music, gay company, fine food, all presented a most unbusinesslike atmosphere. Yet, there seemed to be a lot of talk about extending subways and enlarging airports and doubling capacity of this or that. Maybe the cartoonists are wrong after all when they depict the engineer with tall boots and mackinaw jacket.

There may be some discussion about an Annual Meeting session devoted to "real news in all phases of milady's wardrobe. Skirts are much fuller, have greater sweep, and many feature uneven hemlines." But ask the ladies about it and see if they don't reply that the Thursday reception, tea and fashion show was one of the most pleasant gatherings of the week. For complete change of atmosphere, the ladies went over to the Biltmore Ballroom for their affair. As a matter of fact it will be surprising if some of the ladies don't use this fashion show as the basis for retroactive, "portal-to-portal" demands for a new wardrobe.

Quite different fashions were displayed at the Smoker for men on Thursday evening. An excellent dinner was followed

by a variety of entertainment and ample opportunity for making new acquaintances and continuing conversations begun earlier during the meeting.

Of considerable interest were the two excursions. A bus safari set off on Friday afternoon to inspect housing developments under construction throughout the metropolitan area. Projects of the New York City Housing Authority and the Metropolitan Life Insurance Co. were visited. All stages of construction were exhibited and the party looked in on occupied apartments, hospital clinics, and community facilities that are completed and in operation.

A second group set forth on Saturday to see the U.N. Headquarters. Offices of the Secretariat, Chambers of the Council and the Assembly Hall were visited. Then the trip passed through Flushing Meadow Park and the Lake Success facilities. Operations of the U.N. were outlined by a member of the Secretariat.

Many other formally planned and "spur-of-the-moment" activities packed the week. Among these were the college reunions, which made use of the presence of so many alumni in town to schedule luncheons and dinners.

Ten Technical Divisions held one or two sessions. Brief descriptions of these sessions follow.

Public Understanding Needed to Solve Traffic Problems

BROTHER B. AUSTIN BARRY, Jun. ASCE, New York, N.Y.

PUBLIC UNDERSTANDING OF "the evils and waste resulting from the inefficient circulation of people and goods" was called one of the most important factors in the solution of America's traffic congestion problem at the City Planning Division session. William J. Shea, chief of staff of New York City's planning department, and chairman of the ASCE City Planning Division's executive committee, was author of the paper, read for him by Leslie Williams, city planning engineer, American Transit Association, New York, who is secretary of the executive committee. (See article, page 64.) Frank Malley, planning director, Buffalo, N.Y., City Planning Commission, presided.

Without such public understanding, Colonel Shea's paper emphasized, efforts to solve the problem will be no more than wishful thinking. Citing a survey conducted by the Division, the paper quoted from answers received to questionnaires sent to 23 cities in the United States and Canada, all with populations of more than 100,000.

"How much relief has your city obtained from traffic congestion during the past 12 months?" the cities were asked, as a follow-up to recommendations made by the Society's City Planning Division at the 1946 Annual Meeting that traffic be relieved through improved and modern streets and highways, off-street parking and other terminals, traffic engineering and enforcement, public transportation and long-range city planning.

Replies from the cities quoted in Colonel Shea's paper included the following:

"We have tried to do many things, but I doubt whether there has been much accomplished." "We have been able to accomplish practically nothing in relieving congestion in 1946. A traffic survey was proposed and abandoned, and a bypass for through traffic was publicized." "Authorities have done very little, if anything, during the past five years to make any changes in streets or highways, or provide offstreet parking." "A great deal of field data has been accumulated and traffic recommendations are in the offing, but meanwhile the situation has grown worse." "Staggered hours have been abandoned, resulting in a high evening travel peak, and there is considerable laxity in police enforcements."

"But the outlook is not as pessimistic as it at first appears," Colonel Shea's paper declared, citing widenings, improvements, garage construction and other traffic "decongestion" aids instituted in various cities.

"Chief among the traffic palliatives applied are: prohibition of curb parking and continuous police enforcement; one-way street movement; reduction of left-turning movement; re-routing of transit vehicles and spreading of the loading zones in downtown areas; off-peak curb loading and unloading for trucks; and installation and retiming of traffic signals.

"But there is no panacea for traffic congestion. What is needed in every city is a comprehensive and integrated program of street and expressway improvements, additional off-street parking, truck, and bus terminals, improved transportation, modernized traffic engineering measures, selected and continuous police enforcement, and a public educated to the evils and waste resulting from the inefficient circulation of people and goods.

"The latter is one of the most important of the factors involved in the overall solution of the congestion problem. A revaluation of the respective rights of public property, that is, streets and highways for the accommodation of moving traffic, and private property, that is, property abutting on streets and highways and in which traffic is generated, is an essential element of the problem, since restrictions on the bulk of buildings and the coverage of property will have to be imposed and the design and utilization of structures correspondingly affected. In consequence, any long-range program for effective relief from congestion must be thoroughly understood by property owners and the public generally, and merit their active support if our efforts to solve the problem are to result in other than wishful thinking."

Other papers presented were: "Cities Can't Live Without Trucks," by Hoy Stevens, chief, section of equipment maintenance, American Trucking Association, Washington, D.C., and "Business Program for Community Development Pains," by Newton C. Farr, president, Urban Land Institute, and chairman of the U.S. Chamber of Commerce Committee on City Planning and Related Activities.

Colleges Urged to Teach Construction

BASIC COLLEGE TRAINING in practical aspects of the construction industry, with special emphasis on labor relations, was advocated in a paper presented before the Highway Division session, at which Day Okes, St. Paul, executive committee chairman, presided.

H. W. Richardson, New York, N.Y., executive editor, *Construction Methods*, was the speaker who, in pointing out that even normally construction accounts for more than 10 percent of the nation's economy, emphasized that in record-breaking postwar years, the construction of the country may run as high as 20 billion dollars annually. (See article, page 74.)

Charging that some teachers "have failed to note the advances in mechanization and thus have ignored the greatest impetus to practical civil engineering in modern times," Mr. Richardson declared that, while a few civil engineering schools do make an attempt to include construction courses and a few more offer a smattering of subjects somewhat related to the business, "in no case is a real serious effort made to train students for a life construction career. One reason, perhaps, is that some engineering educators are still prone to regard the construction man as a roughneck, a glorified laborer or mechanic. Actually, he is most likely to be a keen, alert citizen, an ingenious and shrewd operator, a technician with good business sense. Some educators regard construction training solely as a function

of trade schools. However, the need is for educated construction men, not skilled mechanics. The greatest obstacle to the introduction of construction courses in technical colleges seems to be a reluctance on the part of civil engineering schools to adopt new courses or to readjust the curriculum."

On the subject of labor relations and the need for specific training for leaders in the industry, Mr. Richardson said:

"Labor relations are about the first thing a neophyte constructor runs up against upon leaving school. Why should he not at least be prepared with previous study of this all-important subject? Fundamentals of construction management, including safety and job planning, are requisite to the training of the construction man. Construction is a complex, highly competitive business. How it is conducted, planned and carried on would be most valuable knowledge to a student bent upon a construction career. Job management largely means equipment management today, for successful construction is mainly the intelligent use of the excellent tools and machines now available."

Reminding his listeners that "the prime purpose of civil engineering is to provide the physical works that serve mankind," Mr. Richardson emphasized that "that purpose is not fulfilled until the physical structure has been designed, built and put into service," and called upon all colleges to follow the start made by three universities—Columbia, Stanford and Illinois—in establishing construction courses.

John W. Wheeler, Chicago, executive assistant to the president, Chicago, Burlington and Quincy Railway Co., presented the only other paper read before the session. His subject was "Evaluation and Coordination of Transportation."

Symposium on Multiple-Purpose Reservoirs Occupies Two Hydraulics Sessions

S. RALPH ANGELL and HOWARD EDWARDS, Juniors ASCE, New York, N.Y.

THE HYDRAULICS DIVISION divided its symposium on "Design and Operation of Multiple-Purpose Reservoirs" into two sessions, the first presided over by Raymond A. Hill, chairman of the Joint Committee on Design and Operation of Multiple-Purpose Reservoirs, and the second by William G. Hoyt, chairman of the Division's executive committee.

At the first session, Mr. Hill's introductory remarks outlining the subject were followed by three papers: by Malcolm Elliott, retired Corps of Engineers colonel, now a St. Louis consulting engineer; by Nichols W. Bowden, chief of the river-control section, Tennessee Valley Authority, Knoxville; and by E. B. Debler, regional director, U.S. Bureau of Reclamation, Denver.

Colonel Elliott discussed both single-purpose and multiple-purpose reservoirs, and warned that "unless floods always occur during a definite season of the year, it is unsafe to allocate the same storage space to both flood control and navigation. Storage space for flood control may remain vacant and unused for many years, and the temptation to use it for other purposes may be very strong, but it cannot be so diverted and still remain available for protection from floods."

Scheduling of the flow of the Tennessee River is effected at least daily and "several days in advance," Mr. Bowden told the engineers. "During floods, revisions must be made two or three times daily to take into account changes in rainfall and runoff." Since the first reservoir became available on the Tennessee, he stated, there have been 14 floods which would have exceeded a flood stage of 30 ft at Chattanooga. So efficient is the scheduling of the water to make it reach key points at specific times that "all have been reduced by varying amounts from less than 1 ft to more than 10 ft, with total savings at 'the point' of well above 12 million dollars, or an annual saving to that city of over one million dollars."

Mr. Debler discussed the function of multiple-purpose reservoirs in conservation programs.

At the second session Albert L. Cochran, Washington, D.C., head of the reservoir regulation and hydrology branch, Office of the Chief of Engineers, told his hearers that to the flood control planner, combining flood control with other functions—navigation, irrigation, power, conservation—"is a lot like moving in with your relatives. If the house is large enough and located satisfactorily with respect to your place of business, the arrangement may prove to be of great practical and economic advantage, and in case of a housing shortage the action may be essential."

MOST BRILLIANT SOCIAL FUNCTION of New York meeting, dinner dance in Grand Ballroom of Hotel Commodore, has attendance of 550 members, ladies and guests.

Another speaker in the symposium was Wesley R. Nelson, Amarillo, Tex., regional director, U.S. Bureau of Reclamation. He decried the dissimilarity in the approach by different states and agencies to problems of investigations and operations, with consequent confusion in the handling of water matters and said: "Even in a single state, laws may differ, dependent upon the stream changes involved. This situation can only be rectified by the adoption of a national water policy."

Others participating in this symposium were R. J. Pafford, Jr., Omaha, chief of the water utilization branch, Missouri River Division, Corps of Engineers, and the following officials from Washington, D.C., who presented the viewpoints of their respective federal agencies: Col. E. Robert DeLuccia, chief of the Bureau of Power, Federal Power Commission; Rudolph Dieffenback, coordinator of river basin studies, Fish and Wildlife Service; Conrad L. Wirth, chief of lands, National Park Service; and Merrill Bernard, chief of the U.S. Weather Bureau's climatological and hydrologic services.

Industrial Waste Symposium Highlights Sanitary Sessions

C. A. KNAPP and MELVILLE LYMAN, Juniors ASCE, New York, N.Y.

TWO SESSIONS WERE HELD by the Sanitary Engineering Division, one the afternoon of the opening day of the Annual Meeting, and the second the following morning. Prof. George J. Schroepfer, Minneapolis, chairman of the Division's executive committee, presided at the first, and Prof. Gordon M. Fair, Cambridge, Mass., member of the committee, was in the chair at the second.

Following brief introductory remarks by Professor Schroepfer, the first session was marked by presentation of several Division committee reports. Thomas H. Wiggin, New York, N.Y., reported for the Committee on Water Supply Engineering. Samuel A. Greeley, Chicago, chairman of the Committee on Organization, Financing, and Administration of Sanitary Districts, presented that group's final report. For the Joint Committee on Definition of Terms Used in Water Works Practice, covering "A Glossary of Terms Used in Water and Sewer Engineering," Dean Thorndike Saville, of New York University's College of Engineering, presented a final report. Professor Fair submitted a progress report of the Committee on Advancement of Sanitary Engineering, and Edward J. Cleary, New York, N.Y., discussed organization of an Inter-American Sanitary Engineering Association.

Excerpts from Mr. Cleary's report follow:

"Sanitary engineers in the Americas—and that takes in 21 countries in the Western Hemisphere—have united to help make their part of the world a better place in which to live. That is the real meaning of a meeting held in Caracas, Venezuela, last fall, which resulted in the establishment of the Inter-American Association of Sanitary Engineering.

"Formation of the Association represents the culmination of discussions among North and South American engineers for at least seven years. The aim has been to provide a means for closer relations among those engineers who have a common interest in the betterment of sanitary, economic and social conditions in their countries.

"Great impetus to the formation of the association resulted from the wartime activities of the Institute of Inter-American Affairs, which undertook some $60,000,000 of cooperative sanitation work in 18 of the Latin American republics. Another important factor has been the long-time operations of the Pan American Sanitary Bureau, a treaty organization sponsored by the governments of all the American republics.

"Principal object of the association is to reach by common agreement the solution of problems relating to sanitation and the establishment of standards for the uniform and continuous protection of all the peoples of the hemisphere. This purpose is to be accomplished by:

"1. An interchange of ideas and scientific information concerning developments in sanitary engineering.

"2. Establishment of standards of sanitation for the Americas.

"3. Promotion of good will and better understanding among the persons engaged in sanitation work in the Americas.

"Membership is open to engineers and all others engaged in sanitation activities, the annual dues being the nominal sum of $3.

"Headquarters of the general secretary are in Washington, and for the present at least the headquarters and staff expenses will be subsidized in part from Pan American Sanitary Bureau funds with additional aid from the U.S. Public Health Service. In the past, the USPHS has allotted personnel and funds to the bureau for special projects.

"Formation of the permanent organization cannot be made until the newly elected delegates convene at a meeting to be held in Santiago, Chile, this fall. Meanwhile an interim advisory committee is functioning, the members of which are: Abel Wolman, M. ASCE, representing the Pan American Sanitary Bureau; Clarence I. Stirling, the Institute of Inter-American Affairs; and Lawrence M. Fisher, the U.S. Public Health Service. The acting secretary is Donald L. Snow, Jun. ASCE, assigned by the U.S. Public Health Service to the Pan American Sanitary Bureau."

Professor M. Allen Pond, of the Yale University School of Medicine, presented a paper on "Sanitary Engineering Aspects of Housing" at the second session, and this was followed by a symposium on industrial wastes, in which four papers were read.

Rationing of water was held out as a possibility "if conditions do not improve in the not-too-distant future," in the symposium paper of Ogden S. Jones, Lawrence, Kans., chief geologist, oil field section, Kansas State Board of Health, Division of Sanitation.

In his paper, "The Reasons Back of the Kansas State Board of Health Program for the Disposal of Salt Water from Inland Oil Fields," Mr. Jones called for a public awakening to the economic danger in "using more water than formerly and putting less back into the ground than in the years of less water use"—a practice, he said, "we cannot keep up indefinitely." (See article, page 60.)

Professor Don E. Bloodgood, Purdue University, read a paper, "Effect of Industrial Waste Problems on Stream Pollution Legislation and Control," in which he pointed out that a federal law is needed to coordinate the activities of state stream pollution control units. This, he said is true despite failure of passage of any of the nearly 100 bills which have been introduced in Congress during the last 50 years.

Decrying the failure of conservationists and public health officials to agree on what type of federal law is wanted, Professor Bloodgood warned that the 80th Congress must pass an acceptable law, or industry which, he said, has been cooperative and willing to assist in ridding streams of pollution and its attendant menace to downstream water supplies, will lose interest.

"The main reason for failure of any of the bills to pass has been that most of them provided for an extension of federal control," he said. "There is no doubt that a federal law could be written which would lend support to the states, yet would not interfere with the state rights of which many states are so jealous.

In addition to federal legislation which "can serve the citizens of the country to the greatest extent if it coordinates the activities of the state stream pollution control units," Professor Bloodgood recommended:

State legislation authorizing boards

BOARD OF DIRECTION HOLDS ANNUAL MEETING in New York. Clockwise from near corner of table, those present are: Harland C. Woods, Director, District 3; Ralph B. Wiley, Vice-President, Zone III; Lewis M. Gram, Director, District 7; Daniel V. Terrell, Director, District 9; Samuel A. Greeley, Director, District 8; Albert Haertlein, Director, District 2; David L. Erickson, Director, District 16; William M. Piatt, Director, District 10; Harry F. Thomson, Director, District 14; Thorndike Saville, Director, District 1; Howard T. Critchlow, Director, District 4; Frederick W. Panhorst, Director, District 13; William R. Glidden, Director, District 6; Shortridge Hardesty, Director, District 1; Irving V. A Huie, Director, District 1; and Arthur W. Harrington Vice-President Zone I. Inner row next to table, from rear; Charles W. Bryan, Jr., Director, District 1; John H. Gardiner, Director, District 11; Charles E. Trout, Treasurer; Executive Secretary William N. Carey; O. H. Koch, Director, District 15; President, E. M. Hastings. Outer row, at right, from rear: Past-President J. C. Stevens; Gail A. Hathaway, Vice-President, Zone II; Roy W. Crum, Director, District 5; Past-President W. W. Horner; Walden L. Malony, Director, District 12.

with broad powers to establish necessary rules and regulations "which must change with the development of the times."

Well written, reasonable laws on stream pollution which, he predicted, "will not be objected to by industry."

Legislation providing for necessary studies which will bring about development of suitable and improved industrial waste disposal methods.

"Possibilities of Recovery Utilization" was the subject of the paper presented by Dr. F. W. Mohlman, Director of Laboratories, Sanitary District of Chicago, in the symposium.

Three water and sanitation investigators of the U.S. Public Health Service at Cincinnati collaborated in preparation of another paper, "Disposal Methods for Specific Wastes—Synthetic Rubber Plant Liquid Wastes Disposal." They are Frank E. DeMartini, O. R. Placak, and Clarence C. Ruchhoft. (See article, page 59.)

Maintenance of Hydroelectric Plants Gets Attention of Power Division

ELWYN KING, Jun. ASCE, New York, N. Y.

WORK OF MAINTAINING CONCRETE STRUCTURES in temperatures ranging from tropical to sub-zero were detailed at the Power Division session in a paper by R. W. Spencer, chief civil engineer of the Southern California Edison Co. Mr. Spencer was unable to attend the meeting, and M. G. Salzman, Hydraulic Engineer of Ebasco Services, Inc., abstracted the paper for presentation. He stated that, since the range in climate and age of the hydroelectric plants discussed were representative of conditions to which a large number of concrete structures in the United States and Canada are subjected, experience in maintaining and repairing them should be of considerable value to engineers who face similar problems. He went on to list reasons why maintenance may be necessary, and to give methods used successfully by the Southern California Edison Co. G. E. Archibald, also of Ebasco Services, took part in the discussion, and a prepared discussion, by Harvey A. Burt, was read.

This session was presided over by Arthur T. Larned, chairman of the Power Division's executive committee, whose introductory remarks opened the session. Mr. Spencer's paper was also preceded by that of A. V. Karpov, New York consulting engineer, whose subject was "Power and Irrigation in French North Africa—Morocco, Algeria, and Tunisia." The population of these three countries is confined to a narrow coastal belt and has been dependent on irrigation for survival since ancient times. Mr. Karpov pointed out the large part religion plays in decisions on water projects, owing to the necessity of centuries for apportioning the irrigation water. Government control over waters is limited to new water, i.e., supplies newly created by dams. The greatest technical problems of these dams, used for both power and irrigation, is that of generally faulty foundation conditions.

Mr. S. Tschaikowsky, the French Commercial Assistant Attaché in New York, discussed Mr. Karpov's paper and pointed out the great need for further development to provide the area with the freedom from want of the Atlantic Charter. Mr. Joseph Lewin discussed some of the construction problems of four of the rock-fill dams, emphasizing the excessive amount of grouting.

Soil Mechanics and Foundations Division Discusses Earth-Pressure Tests and Bulkheads

JOSEPH WARD and EMILE HUSAR, Juniors ASCE, New York, N.Y.

TWO SESSIONS WERE HELD by the Soil Mechanics and Foundations Division, one on Thursday morning and the other Thursday afternoon. Presiding officer at both sessions was Frank A. Marston, chairman of the Division's executive committee. Introductory remarks by Rear Admiral William H. Smith, director of planning and design, Bureau of Yards and Docks, Navy Department, opened the first session, at which three papers were presented.

Gregory P. Tschebotarioff, associate professor of civil engineering at Princeton University, discussed the large-scale model earth-pressure tests on flexible bulkheads which he has been conducting under the Palmer Stadium at the university. The next paper, dealing with special features of these earth-pressure tests, was prepared by three men connected with the Princeton Soil Mechanics Laboratory: Edward R. Ward, Assoc. M. ASCE, research associate, and John R. Bayliss and Philip P. Brown, research assistants. The third speaker, Harris Epstein, principal designing engineer, Bureau of Yards and Docks, Navy Department, presented a paper on the application of test results to bulkhead design.

At the Thursday afternoon session three men from the Navy's Bureau of Yards and Docks presented papers. L. A. Palmer, senior engineer, read a paper on "Some Experiences with Soil Types in Naval Construction." Captain John C. Gebhard, design manager, and Commander L. C. Coxe, assistant design manager, collaborated on the second paper, "Types of Bulkhead Failures and Their Causes." Discussion of papers presented at both sessions terminated the meeting.

Waterway Clearances Topic of Engineering Economics Group

EDWARD COHN, Jun. ASCE, New York, N.Y.

PRESIDENT TRUMAN WAS CREDITED with an assist in facilitating inland navigation through fairer division of costs of supplanting outmoded railroad and highway bridges with modern structures, at the Engineering Economics Division meeting. With Maj. Charles T. Leeds, Los Angeles, Corps of Engineers, retired, presiding, the Division heard a symposium on "Problems of Waterway Clearances Involved in the Crossing of a Water Traffic Route by a Land Traffic Route." (See articles, page 67.)

The President's contribution in this field, it was brought out, was made while he was a senator and sponsored the legislation which became the Truman-Hobbs Act. Papers in the symposium were by: Maj. Charles T. Leeds; Lt. Gen. Raymond A. Wheeler, Washington, D.C., Chief of Engineers, U.S. Army; Louis C. Sabin, Cleveland, vice-president, Lake Carriers' Association; J. H. Porter, executive officer, U.S. Engineers, St. Louis; and J. B. Akers, Washington, D.C., chief engineer, Southern Railroad System. Major Leeds outlined the general problem, arising from advances in river transportation which caused some bridges to interfere with navigation. General Wheeler told how the government weighs all considerations in deciding which structures need remodeling or require replacement, and Messrs. Sabin and Akers presented the problems of the water and land shippers, respectively.

Consensus was that the Truman-Hobbs Act, enacted in 1940, and providing for the first time that the federal government bear a fair share of the cost of such alterations or replacements as it rules necessary, is proving of much assistance in facilitating arrangements for new and modern bridges. When men and materials are more plentiful, the tempo of such construction work is expected to be speeded up, the speakers indicated.

Aerial Photography Speeds Route Location, Surveying and Mapping Symposium Declares

BROTHER JOSEPH McCABE, Jun. ASCE, New York, N.Y.

AERIAL PHOTOGRAPHY IS speeding up the work of locating routes for the expressways, parkways and other lanes needed to relieve postwar traffic congestion, it was emphasized at the Surveying and Mapping Division session.

What's more, this streamlined path-finding method is doing the job better, relieves men for other technological duties in these days of manpower shortage, and "costs only a fraction" of what ground surveys would cost, it was brought out in a symposium over which Prof. Philip Kissam, Princeton University, the Division executive committee's chairman, presided.

Authors of papers presented in the symposium on "Use of Aerial Photography in Highway Location in the Northeastern States," were: E. T. Gawkins, deputy chief engineer, New York State Department of Public Works, Albany; W. J. Cox, Connecticut state highway commissioner, Hartford; Spencer Miller, Jr., New Jersey state highway commissioner, Trenton; and Elmer C. Houdlette, director, survey division, Massachusetts Department of Public Works, Boston. (See articles, page 80.)

Aerial photography for mapping work has been used occasionally as far back as the early twenties, the speakers declared, but, they pointed out, it now has been developed to a point that prompted them to attribute to the practice:

Reduction of costs of reconnaissance surveys from $10 or $12 per acre to about $1.25 per acre.

Easier readability than maps, particularly useful in condemnation proceedings, where laymen juries are concerned.

Better choice of scenic routes.

High value as exhibits in damage suits, where the before-and-after photos are important in showing exactly what portions of a property are damaged or destroyed during construction.

In addition, the symposium speakers declared, pictures are helpful in construction work, since in many cases the location of gravel and other construction material can be determined from the photograph, without going into the field. Also, they said, in some instances soil types may be determined from the pictures, so complete is the inventory of surface features the photos furnish.

Another feature of the method on which emphasis was placed is the fact that the pictures enable the engineer readily to determine complete present land utilization, such as whether built-up sections are residential or industrial, and the proximity of schools, golf courses and cemeteries.

Elimination of speculation and friction with land owners whose property may be taken was placed high on the list of benefits derived through use of aerial photography for location of highways. Formerly land owners became and remained hostile throughout the survey,

whereas now, with aerial photographs to aid them, state officials can place all the facts and proposals before the property owners at the time they are first contacted.

Structural Division Discusses Steel Weight Saving

PAUL OBERLEITNER, Jun. ASCE,
New York, N. Y.

SAVINGS UP TO 30 percent in the weight of steel beams used in concrete-floor highway bridges are made possible by a relatively new design in which the steel beams are interlocked with the concrete slab. it was brought out in a series of three papers presented before the Structural Division session, at which Alfred Hedefine, New York, executive committee chairman, presided. The papers are results of a research program, still in progress, at the University of Illinois. F. E. Richart, research professor of engineering materials, presented a paper, "A Review of Highway Bridge-Floor Research at University of Illinois;" F. M. Newmark, research professor of civil engineering, had a paper on "Design of I-Beam Highway Bridges;" C. P. Siess, special research associate professor of theoretical and applied mechanics, presented the last paper, on "Composite Construction."

Describing "composite construction" as a design which provides for rigid connection between the concrete slab which forms the roadway of the bridge and the steel I-beams on which it rests, Professor Siess emphasized that the new design enables bridge builders to obtain greater "stiffness" in their structures. This is accomplished by welding steel clips to the tops of the beams and embedding them in the concrete as it is poured. In ordinary concrete-floor bridge construction, the slab merely rests on the steel beams. Professor Siess discussed in particular the design and behavior of various shear connectors, of which a channel welded with a flange to the beam gives best practical results.

In further description, Professor Newmark discussed slab and beam design. Important features of design are that the slab and beam act as a T-beam, making the full slab width effective, and permitting the use of lighter and shallower beams. Economies are further realized by using a thicker bottom flange, produced by the addition of a cover plate. Greater proportions of wheel loads are carried by the beam with an increase of slab thickness. Main reinforcing steel is placed transversely to the beams, and longitudinal steel is necessary for secondary stress.

Professor F. E. Richart's paper illustrated "composite construction" and testing procedures involved. The use of slides in all papers clearly portrayed methods and results of analytical and experimental work. Some 36 scale models and 200 specimen slabs were tested, necessitating construction of movable testing apparatus around test models. Simple, continuous, right, and skew spans were tested before and after cracking had occurred. Results have shown analytical design methods to be conservative.

The results of the research are simpler usable design procedures, verified by tests, which have been published in a series of bulletins by the University of Illinois. Upon completion of this program many constructive advances will have been made to further the increased use of composite construction.

Port Terminals Discussed at Waterways Session

DEVOTING ITS ENTIRE session to the subject, the Waterways Division discussed "Port Terminal Functional Requirements," a paper presented by C. R. Denison, port engineer, Port Development Division, U.S. Maritime Commission, Washington, D.C. Colonel C. L. Hall, New York, chairman of the Division's executive committee, presided.

Washington Award Goes to Dr. Karl T. Compton

"FOR PROGRESSIVE ADMINISTRATION of engineering education, for leadership in research and for advancement of American industry in technology," the Washington Award for 1947 goes to Dr. Karl T. Compton, president of the Massachusetts Institute of Technology. The award will be presented at a dinner at the Hotel Continental in Chicago on February 26, sponsored by the Western Society of Engineers.

Established in 1916 by John W. Alvord, of Chicago, the Washington Award is administered by the Western Society of Engineers on the recommendation of a commission representing the Four Founder Societies and the Western Society of Engineers. Previous recipients include Herbert Hoover, Orville Wright, Michael Pupin, and Ralph Modjeski.

Dr. Compton was educated at the College of Wooster (Ohio) and at Princeton University. In 1915, after several years on the faculty of Wooster and Reed colleges, he became assistant professor of physics at Princeton. He was full professor from 1919 to 1930, and chairman of the department in 1929 and 1930. Since 1930 Dr. Compton has been president of M.I.T. During the war he served on the National Defense Research Committee. He is the author of more than a hundred publications dealing with research in photoelasticity, the ionization of gases, electric arcs, and other miscellaneous subjects in the field of physics, and has received many scientific and educational honors.

Alabama Section Commends ASCE Salaries to Officials

FIRST ACTION IN which a Local Section utilized the new ASCE interim classification and compensation plan in focusing employers' attention on inadequacy of civil engineers' salaries is reported by the Alabama Section. The action was taken at the Section's recent two-day annual meeting in Mobile, and was based upon recommendations made by its own committee on classifications and salaries, which expressed gratification for the plan adopted by the ASCE Board of Direction at its Fall Meeting in Kansas City in October and reported: "For this action, the Board of Direction is to be commended."

Principally, the resolution adopted by the Alabama Section calls attention of the Governor of Alabama and other state officials to the inadequacy of engineers' salaries and recommends an upward adjustment "to place them in line with the recommendations adopted by the American Society of Civil Engineers." The salaries recommended by ASCE are virtually identical with federal salaries which have been in effect throughout the country since July 1, 1946.

Another action taken by the Alabama Section touching on public affairs was the adoption of a resolution decrying previously allotted amounts for inventory of mineral and water resources as "inadequate to carry on such investigations" and requesting the Legislature of the State of Alabama to appropriate, and the Governor to approve, "the amount of $15,000 recommended by the State Geologist as necessary."

The following officers and directors were elected for 1947: J. F. Tribble, president; Walter Schielke, 1st vice-president, Philip Davis, 2nd vice-president; A. N. Beck, secretary-treasurer, and T. F. Hobart, S. J. Cumming, J. H. Mayer, Col. D. H. Barger, and Harry Myers, directors.

Addresses by Col. H. I. Collins, U.S. Engineer Department, and J. T. Ewin, who discussed the Port of Mobile, were followed by presentation of a life membership to Nicholas H. Holmes. Included on the program were a water works inspection trip and a harbor trip aboard the State Docks boat, *Dixie*.

Student Chapters Hold New York Conference

FRANK DELVERS
Chairman, Metropolitan Conference of Student Chapters

DELEGATES FROM STUDENT CHAPTERS from Maine to Virginia and from as far west as Pittsburgh, took part in the New York Conference of Student Chapters held January 15, during the Society's Annual Meeting. Highlighting the conference was a specially arranged session on Wednesday afternoon for and by students. Hosts for the occasion were the eight Chapters forming the Metropolitan Conference of Student Chapters.

At the afternoon session, welcoming remarks were addressed to the group by Francis P. Scheffner, chairman of the committee arranging the conference, and Frank Delvers, chairman of the Metropolitan Conference. The incoming president of ASCE, Edgar M. Hastings, who was at one time chairman of the ASCE Committee on Student Chapters, demonstrated his vital interest in students and their affairs in his brief address to the assembly. Following the President's talk, the present chairman of the Student Chapter Committee, Col. R. A. Marr, Jr., told the group about the rapidly expanding activities of ASCE Student Chapters and outlined some helpful suggestions for improving Chapters' programs.

Expression of engineering ideas is too often given little attention by engineers in their training program, according to Donald D. King, editor of CIVIL ENGINEERING. In his address to the group Mr. King discussed ways and means for improving the effectiveness of engineers in their contacts with the public. Clarity in writing and speaking were held to be basic essentials.

Later in the program, Dr. John J. Theobald, dean of administration at the College of the City of New York, analyzed the relationship and difference between "Engineering, and Applied Science."

A profitable exchange of experiences among delegates from various Chapters occupied the remainder of the afternoon. A surprise of the program was the presentation to President Hastings, by members of the VMI Student Chapter, of an etching showing a part of the campus of Virginia Military Institute. This gift was given in recognition of Mr. Hastings' active interest in Student Chapter work.

ASCE Division Committee Expands Opportunities for Construction Engineering Education

TO ENCOURAGE THE TRAINING of students in construction engineering, the ASCE Construction Division's Committee on Construction Engineering Education has two main objectives. As stated in its progress report of November 7, 1946, they are:

1. To encourage several colleges of engineering, advantageously located near large centers of population, to offer optional programs of integrated courses that emphasize the fundamental aspects of construction engineering.
2. To encourage all other colleges of engineering to introduce one or more courses pertaining particularly to construction as electives, or as required courses, in their architectural and civil engineering curricula.

In pursuing the first of these objectives the committee has selected three colleges—Stanford University in the San Francisco region, Columbia in the New York region, and the University of Illinois in the Chicago region. Stanford is offering an optional program in construction engineering which terminates with the senior year in civil engineering. The Department of Civil Engineering of Columbia University is giving serious and favorable consideration to the formulation of a fifth-year program which will include appropriate fundamental courses and a thesis on some phase of construction. The situation at the University of Illinois is not as far advanced although the authorities there are interested.

The Committee's aim is to join with the institution in a planned cooperative effort to encourage associations of contractors, equipment manufacturers, and other interested agencies to provide funds and other assistance for the support of the new optional programs in construction engineering. Forms of assistance that may be supplied under this plan have been classified and are included in the committee's report to the Construction Division.

The committee's second general objective will involve making a survey of the opinions of interested and experienced engineers—largely as represented by the membership of ASCE's Construction Division—regarding the subject matter to be incorporated in courses on construction engineering. In this connection the report by the ASCE Committee on Engineering Education, cooperating with the Cooperative Committee on Civil Engineering Education of the American Society for Engineering Education, published in the March 1946 ASCE PROCEEDINGS, is of interest. This report showed that among the civil engineering subjects being offered in colleges, Construction Engineering (Estimates and Costs; Planning and Plant Management) was rated as of great importance in 660, of moderate importance in 286, and of little importance in only 54, of the 1,000 questionnaires returned.

In 1940, nearly one-third of the colleges of engineering were offering one or more courses pertaining to construction—most of them relatively recent and in a state of flux. Since that time many revisions in prewar engineering courses have been brought about by the war training programs, depletion and rebuilding of instructional staffs, reduced technical courses in undergraduate curricula, planned fifth-year programs, large registrations, etc.

The new program at Stanford consists of the addition of a construction engineering option in the civil engineering curriculum. This is an undergraduate program set up to fill the needs of the student who plans to enter the construction industry as a member of a contractor's organization. The new program varies from the normal civil engineering curriculum in that some courses have been shortened or eliminated and the following have been added:

1. Construction Estimates and Costs
2. Construction Equipment and Methods
3. Industrial Organization and Management
4. Business Law
5. Industrial Relations

The first two of these courses are new, and the others already are included in the curricula of other departments in the university. The construction option was made available to students registering for the 1946 fall term.

In cooperation with Winfield Arata, Assoc. M. ASCE, director of the Northern California Chapter of the Associated General Contractors of America, arrangements were made for students to work for several large contractors last summer. Similar opportunities for student employment are expected to be available next summer. An agreement was reached with the vice-president of the Laborer's Union in San Francisco which allows students to work on jobs under the jurisdiction of the union merely by paying union dues, but without being required to join the union or pay the initiation fee.

Tennessee Valley Engineer Looks at "The Year Ahead"

AN EXAMPLE OF the increasing interest being manifested by ASCE Local Sections in Society affairs and the professional advancement of members, in addition to their technical improvement, is furnished in the January issue of the *Tennessee Valley Engineer*, publication of the Tennessee Valley Section.

Its leading article, an editorial, looks at "The Year Ahead," and states in part:

"To engineers, 1947 should greatly clarify the issue of professional status both for employers and employees. On the West Coast and at scattered other locations throughout the country, unions have struck construction projects because employers refused to require engineers to become members of a trades union. Employee engineers are threatened with the loss of their means of livelihood unless they join unions instead of having the right of collective bargaining through organizations of their own choosing. The American Society of Civil Engineers through its Committee on Employment Conditions is seeking an amendment to the Wagner Act that will recognize and safeguard the professional character of engineers. These crucial issues are paramount in the future of engineering in this country, and 1947 should see them brought to a settlement.

"Within our American Society itself, there are matters to be decided that will shape the future of the Society. Chief among these is that of raising dues to keep pace with the costs for carrying on Society affairs in a manner in keeping with the current activities that a virile organization should be undertaking. President Horner talked about this in Chattanooga at our Annual Meeting. Local Section opinions will largely decide whether the increase is to be made so that the Society may go forward or whether it shall be denied, with almost certain retrogression of the Society.

"Generally speaking, the engineer has been prone to be indifferent to world affairs and to matters of community interest. In the past, he has coasted along and has gotten by. But it is doubtful if he can do this in the future. Certainly he should not for he is inescapably involved as a citizen, as a person, in the answers that are worked out, for example, for the control of atomic energy, for world disarmament, for industrial peace between capital and labor, for a formula that will prevent disastrous disruption of the nation's business by labor troubles.

"Engineers, including the members of the Tennessee Valley Section, have a selfish interest during 1947 in being alert to those problems which concern their welfare and that of their families and their children. They have an obligation to society to participate not only as engineers but as citizens in shaping the solutions of those problems upon which the future of mankind depends. Is it too much to hope that the engineer will not be found wanting in this critical situation in his duty as a citizen of the world?"

W. D. Shannon Succeeds McNew as Vice-President

IN ACCORDANCE WITH a constitutional provision, which stipulates that a vacancy in the office of Vice-President shall be filled by the senior Director from the same Zone, W. D. Shannon will complete the unexpired term of ASCE Vice-President J. T. L. McNew, who died on December 21.

W. D. Shannon

In Mr. Shannon's early career, he was construction superintendent on several California projects, including the Big Creek and Caribou hydroelectric projects and the Snow Mountain Water and Power Co.'s project. From 1923 to 1932 he served as project manager on a series of large jobs—among them the Baker River hydroelectric project, the Shuffleton steam plant, the Rock Island hydroelectric project, some 300 miles of high-voltage transmission lines, in addition to a number of primary substations.

Since 1932 Mr. Shannon has been engaged in private engineering and property management in Seattle. In August 1941 he organized the offices of the War Production Board in the Northwest, and he served as district manager until February 1943.

Elected an Associate Member of the Society in 1911 and Member in 1918, Mr. Shannon was completing a three-year term as ASCE Director from District 12 at the time of Vice-President McNew's death.

Also he has served on the Society's National Construction Division Committee and on the Columbia University Scholarship Committee. He has been vice-president and president (1942) of the Seattle Section, and for three years was chairman of the local membership committee.

Mr. Shannon's interest in civic affairs and good government is attested by the fact that, in the November 1946 elections, he was a successful candidate for election to the Washington State Legislature from the forty-third district, defeating his opponent by more than two to one.

Ladies Edit December "Tennessee Valley Engineer"

COGNIZANCE OF "the woman behind the engineer" is taken by the *Tennessee Valley Engineer* in its December issue, which was written and edited entirely by the ladies of the Tennessee Valley Section.

Contributions range from Ethel Kellogg Wiersema's highly provocative editorial, calling on engineers for increased and more effectual participation in national and international affairs, to gay reminiscences on "Life as an Engineer's Wife" by Mrs. W. G. Stromquist. Mrs. Wiersema strikes the keynote of the issue with the comment, ". . .I believe with Pierre Van Passen that 'Earth Could Be Fair'—but I believe it could be fairer faster if the engineer, while going on brilliantly in the technical field, would break sharply with the tradition which has chained him to the slide rule and the blueprint, and more freely lend his able intellect to the wide, deeply challenging problems of our time."

There are thoughtful articles on women in the engineering field by Martha Glaser and Jean Glaser, of the TVA staff, in addition to a "President's Wife's Column" by Mrs. W. F. Moehlman, pinch-hitting for her husband.

Heading the all-woman staff was Claire Bennett, who is regularly associate editor of the magazine. Miss Bennett is engineeering aide in the Hydraulic Data Division of the TVA.

Los Angeles Yearbook Boosts Membership

WITH A TOTAL of 1,360 members, of whom 839 are subscribing, Los Angeles is now second only to the Metropolitan Section in size. A record 15 percent increase in subscribing members for 1946 is credited to the work of the Junior Forum Committee, which prepared the Section's yearbook.

In June 1946 a yearbook questionnaire was mailed to all ASCE members in the Section's area. The same questionnaire was sent to subscribing and non-subscribing members alike, but each non-subscribing member was also sent a Section membership application form, and a letter inviting him to join the Section. Among the advantages of subscribing membership mentioned in this letter was that of receiving the Section yearbook, in which the new member would be listed along with all the other subscribing members. Of the 630 non-subscribing members thus approached, 110 responded by applying for Section membership.

The yearbook, which carries in compact form much information of value to engineers in the Los Angeles area, was printed

in October and distributed to the subscribing membership in November. Members of the Junior Forum Committee have received many compliments on the book, and the Section is considering the possibility of issuing it yearly to make it a "Who's Who in Civil Engineering in Southern California."

World Engineering Conference Organized

NEW IMPETUS TO the formation of a permanent World Engineering Conference (WEC) was given at a recent meeting in Paris, in which engineers from many countries participated. Thirteen engineers from the United States, who were in Paris attending a meeting of the International Technical Congress, constituted themselves unofficial representatives of the engineers of this country. Total attendance was about 1,200. Col. C. E. Davies, secretary of the ASME and a member of Engineers Joint Council, who was in Paris as ASME delegate to the International Technical Congress, acted as EJC representative in the planning for the new world engineering organization. EJC has requested its five constituent societies to participate in WEC (see CIVIL ENGINEERING, January 1947, page 54).

The general purpose of WEC is to encourage international contact and cooperation among the engineers of the world. Through the operation of WEC, a way is provided on a world-wide basis for engineers continually to explore ways of helping one another contribute to the progress of mankind.

Fenton B. Turck, of New York City, a member of ASME and of the EJC Committee on International Relations, was appointed by the United States representatives at the Paris organization meeting to represent the United States on the Council or Engineering Board of WEC, until formal American organization and appointments can be brought about. In reporting to Engineers Joint Council on the formation of WEC, Mr. Turck said, "American engineering must be fed from without as well as from within. By coupling importation of foreign accomplishments with liberal exporting of our own ideas and techniques, the engineering profession throughout the world will benefit. And the benefits will not be confined to areas outside the United States."

WEC has political as well as economic aspects which, Mr. Turck asserts, make that organization doubly deserving of support by American engineers. In this connection he reported, "WEC is a step in the right direction and a longer step than any taken in 25 years of intermittent progress toward the formation of such an organization. For this reason alone, WEC is deserving of support and interest all along the line, both within American engineering societies and in relations between American engineers and their foreign associates. Any expression of American interest will be reciprocated twofold from abroad, where American confidence and American leadership are regarded more highly than anyone who has not been abroad recently can realize. Increasing consolidation of engineers in the United States and better relations between American and foreign engineering societies will be the evidence our colleagues in Europe and Asia are looking for."

In his report of December 30, 1946, to EJC, Mr. Turck emphasized that the somewhat tentative organization developed at Paris would not necessarily represent WEC in its final form. He stated, however, that "the formation of the World Engineering Conference is evidence of the desire of engineers to perpetuate the advances of world cooperation of the engineering profession. The spirit rather than the form of organization justifies support of every engineer throughout the country."

Fenton B. Turck

Col. C. E. Davies

Society Sponsors New Foundations Standard

UNDER THE SPONSORSHIP of ASCE, a sectional committee of the American Standards Association has been preparing a proposed standard on "Excavations and Foundations, A56." This covers excavations, shoring, underpinning, borings, tests and bearing values of soils, footings, retaining walls, piles, and foundation piers.

This standard has now been acted on and formally accepted by the Society. Next, it will receive final action by ASA and will then be issued as an American Standard in printed form. Information about the proposed standard may be obtained by interested engineers from the ASA, 70 East 45th Street, New York 17, N.Y.

Many prominent engineers, most of them members of ASCE, have cooperated in the preparation of this standard. Chairman of the ASA Sectional Committee A56 is William H. Mueser, M. ASCE, New York consulting engineer. Together with H. Englander and Lazarus White, he represents ASCE on the committee.

Representatives of other national organizations cooperating in the work include the following members of ASCE:

R. R. Zipprodt—American Concrete Institute
Stephen F. Voorhees—American Institute of Architects
Ole Singstad—American Institute of Consulting Engineers
F. E. Fahy—American Iron & Steel Institute
W. S. Housel—American Society for Testing Materials
Ralph H. Mann—American Wood-Preservers' Association
Edward P. Palmer—Associated General Contractors of America, Inc.
C. A. Hogentogler—FWA, Public Roads Administration
Frank H. Alcott and F. J. Hanrahan (alt.)—National Lumber Manufacturers Assoc.
A. J. Boase (alt.)—Portland Cement Association
Edward W. Roemer—New England Building Officials Conference
Harry C. Plummer—Structural Clay Products Institute
Carl A. Trexel—U.S. Navy Department, Bureau of Yards and Docks
Col. B. C. Dunn—U.S. War Department

Members at large, all members of ASCE, are the following: Donald M. Burmister, A. Cassagrande, Glennon Gilboy, W. C. Huntington, William P. Kimball, D. P. Krynine, G. Tschebotarioff, and D. G. Baillie, Jr.

Tellers Canvass Final Ballot for Officers

January 8, 1947

To the Ninety-Fourth Annual Meeting
American Society of Civil Engineers

The tellers appointed to canvass the Ballot for Officers of the Society for 1947 report as follows:

For President:

Edgar Morton Hastings	5,263
Scattering	5
Blank	12

For Vice-Presidents:

Zone II

Gail Abner Hathaway	5,234
Scattering	15
Blank	31

Zone III

Ralph Benjamin Wiley	5,245
Scattering	5
Blank	30

For Directors:

District 3

Harland Clark Woods	5,242
Scattering	7
Blank	31

District 5

Roy Winchester Crum	5,244
Scattering	4
Blank	32

District 7	
Lewis Merritt Gram	5,242
Scattering	2
Blank	36
District 8	
Samuel Arnold Greeley	5,247
Scattering	1
Blank	32
District 9	
Daniel Voiers Terrell	5,246
Scattering	0
Blank	34
District 12	
Walden LeRoy Malony	5,244
Scattering	0
Blank	36
District 16	
David Leonard Erickson	5,239
Scattering	3
Blank	38
Ballots canvassed	5,280

Ballots withheld from canvass:

From members in arrears of dues	0
Without signature	0
Total withheld	0
Total number of ballots received	5,280

Respectfully submitted,

GEORGE L. FREEMAN, *Chairman*
GEORGE T. GILMAN, *Vice Chairman*

Hyman H. Cashdan	H. F. Hormann
A. Cortland	J. A. Lenecek
William H. Dieck	J. D. Parsons
Michael E. Fiore	E. L. Pavlo
F. V. Hayes	N. D. Richardson

Tellers

EJC Report Is Featured in Northeastern Journal

A REPORT ON Engineers Joint Council, made by a special committee to the Northeastern Section of ASCE, was condensed and featured on the front page of the *Journal of the Engineering Societies of New England* in its December 23 issue.

The report, by Arthur L. Shaw, Frederic N. Weaver, and Stanley M. Dore, thus became available in condensed form to members of all the societies comprising the organization. The ASCE committee was appointed by the Northeastern Section some time ago to make a special study and report on EJC. All Local Sections of ASCE were urged to make similar studies in an effort to bring EJC and its activities to the attention of individual members throughout the country.

Meetings of Board of Direction, January 13, 14, 16, 1947

Digest of Principal Actions

Annual Report

THE BOARD OF DIRECTION approved the Annual Report prepared by the Executive Secretary for the fiscal and calendar year 1946. Among many items of interest, the report showed that of the $567,553 received for Society activities during the 1946 fiscal year, $327,493, or 57.7 percent of total receipts, was supplied through membership dues. Total expenditure for the year was $566,891. Membership in the Society on December 31, 1946, was 21,245.

Two Amendments to Constitution Proposed

The Executive Secretary was directed to prepare a form of petition and a statement to facilitate the development of petitions looking to the authorization of balloting the corporate membership on two amendments to the Society's Constitution. One amendment would give Juniors the right to vote and the other would authorize an increase in annual dues. The increase proposed is $5.00 for Corporate Members and Affiliates and $2.50 for Juniors.

The complex and long considered problem of basic changes in membership grades, in membership qualifications, in names of the grades and other relevant matters is being held in abeyance awaiting a ballot on the question of voting privileges for Juniors.

Action on Membership Grades Postponed

For the past two years or more, the Committee on Membership Grades has had under consideration many proposals for changes in membership grades; qualifications for the several present grades; changes in the designation of these grades; addition of other grades; and other matters pertinent to this complex subject. The Committee plans soon to submit a questionnaire to the entire Society membership for the purpose of obtaining opinion on all membership grade questions. Tabulation of the results of this questionnaire will indicate to the Board the constitutional amendments, if any, which the members in all grades wish to have placed to ballot. If, in the meantime, the presently considered amendment to give Juniors the vote passes, Juniors will then be authorized to vote on all future constitutional amendments, including this broad question of overall changes in membership grades, titles and qualifications.

Conference on Engineering Education

Under the leadership of the late Vice-President McNew, an exploratory conference was called to cover the subject of engineering education and related matters. Clarence L. Eckel, chairman of the Committee on Engineering Education, was elected chairman of the conference, on which were represented his committee and representatives of the following listed Society committees and other organizations: Employment Conditions, Student Chapters, Juniors, Engineers' Council for Professional Development, and American Society for Engineering Education. Representatives of the ASCE headquarters staff also took part in the conference.

The objective of the conference was to explore ways and means for better cooperation among the committees and organizations engaged in the matters of education and welfare of young men in engineering—before they enter the university, during university schooling, and for several years after graduation. The conference developed a number of definite recommendations which will go before the Board for action at its April meeting.

Committee on Employment Conditions

This committee reported marked progress regarding Society efforts to obtain changes in national legislation along the lines of the three fundamental principles adopted by the Board of Direction. (See CIVIL ENGINEERING for November 1946, page 511.) It was reported also that EJC recently adopted the ASCE "three fundamentals" and has requested each member society of EJC to appoint a delegate to serve with E. L. Chandler, Eastern Representative of ASCE, of Washington, D.C., on a special panel for the furtherance of remedial labor legislation affecting the engineering profession.

Application Procedures

The move toward simplification of application procedures, launched at the October 1946 meeting, was advanced by the completion of a special committee. The committee appointed is composed of Vice-President A. W. Harrington, chairman, H. T. Critchlow, I. V. A. Huie, J. H. Allen, B. L. Bigwood, Dean G. Edwards and William N. Carey.

War Department Survey

Following a request by Col. James L. Walsh, through Engineers Joint Council, the Board of Direction agreed, singly or jointly with other EJC societies, and without commitment as to any appropriation at this time, to cooperate with the War Department in a survey of special skills and qualifications of civil engineers.

Steel Joist Standard Adopted

Upon recommendation of the Executive Committee of the Structural Division of ASCE, the Board approved adoption by American Standards Association of a new

standard on building code requirements for steel joist construction. This standard has been under consideration for more than a year by ASA Committee A-57.

Increase in ECPD Allotment

An increase was approved in the amount of $225 in the ASCE allotment to Engineers' Council for Professional Development (ECPD), making the total allotment by ASCE to ECPD for the fiscal year $1,925.

The Board also went on record against a proposed ECPD program to raise a $250,000 endowment fund through a campaign of personal solicitation.

Committee on National Affairs

Malcolm Pirnie, I. V. A. Huie, and R. B. Brooks were appointed as a Committee on National Affairs. It will advise and guide the Society in activities regarding all national legislation concerned directly with the welfare of the profession.

Committee on Municipal Procedures

ASCE will sponsor the formation of a joint committee to act with the American Institute of Consulting Engineers, the American Municipal Association and other similar organizations. It is hoped that from the deliberations of such a committee, recommendations can be developed toward satisfactory procedures for the engagement of engineering consultants by units of local government.

Control of Budgets of Technical Divisions

The Committee on Division Activities was given supervisory control of funds budgeted by the Board of Direction for the activities of the 13 Technical Divisions of the Society.

ASCE Participation in World Congress

On request of Engineers Joint Council, the Board authorized the President to appoint an ASCE delegate to a National Commission to be formed by delegates from all competent engineering bodies in the United States. (See page 102.) This action indicates a willingness on the part of ASCE for limited participation, for the present, in the activities of the World Engineering Congress formed in Paris last September.

Valley Authorities

The question of ASCE's position on the creation of future "valley authorities" formed on the general pattern of TVA was brought before the Board. The matter was deferred and ordered placed on the agenda for the April 1947 meeting.

Committee on Publications

Review of technical papers for PROCEEDINGS is now about abreast of the supply, the Committee on Publications reported. The appointment of a new assistant to the editor of PROCEEDINGS was announced. He is H. P. Orland, Jun. ASCE, of Little Neck, N.Y. Paper for publishing the 1946 volume of TRANSACTIONS finally has been obtained, but at a price about three times greater than for the last previous purchase. Paper and printing of Society publications cost about one-third more per page than a year ago, thus adding another burden of many thousands of dollars on the funds of the Society for this essential service.

Committee on Salaries

The Committee reported progress on further development of its report to supplement the interim report published in CIVIL ENGINEERING for November 1946, page 510. A special task, newly assigned to the Committee, relates to salaries of engineering teachers in colleges and universities.

Akron Section Authorized

On request of members in and near Akron, Ohio, and with the consent of other existing Sections affected, the Board authorized the formation of a new Section to be known as the Akron Section. When this Section is organized, the total number of ASCE Sections will be 66.

Special Budget Committee

The Board approved the formation of a special committee to review the matter of preparation of the Society's Annual Budget and related matters. The committee authorization excludes members of the Society's Executive Committee.

Society Committees

EXECUTIVE COMMITTEE: E. M. Hastings, *Chairman;* C. W. Bryan, *Vice-Chairman;* W. W. Horner, J. C. Stevens, A. W. Harrington, Gail A. Hathaway.

COMMITTEE ON HONORARY MEMBERSHIP: E. M. Hastings, *Chairman;* J. C. Stevens, *Vice-Chairman;* W. W. Horner, W. D. Shannon, A. W. Harrington, Ralph B. Wiley, Gail A. Hathaway.

COMMITTEE ON DISTRICTS AND ZONES: A. W. Harrington, *Chairman;* Ralph B. Wiley, *Vice-Chairman;* W. D. Shannon, Gail A. Hathaway.

COMMITTEE ON PROFESSIONAL CONDUCT: Thorndike Saville, *Chairman;* F. W. Panhorst, *Vice-Chairman;* Albert Haertlein, H. C. Woods, S. A. Greeley.

COMMITTEE ON PUBLICATIONS: Harry F. Thomson, *Chairman;* Shortridge Hardesty, *Vice-Chairman;* John H. Gardiner, William M. Piatt, Roy W. Crum.

COMMITTEE ON MEMBERSHIP QUALIFICATIONS: H. T. Critchlow, *Chairman;* Albert Haertlein, *Vice-Chairman;* O. H. Koch, W. R. Glidden, L. M. Gram, W. L. Malony, D. L. Erickson.

COMMITTEE ON DIVISION ACTIVITIES: A. W. Harrington, *Chairman;* Ralph B. Wiley, *Vice-Chairman;* Harry F. Thomson, Shortridge Hardesty.

COMMITTEE ON SOCIETY RELATIONS: I. V. A. Huie, *Chairman;* Roy W. Crum, *Vice-Chairman;* C. W. Bryan, Jr.

COMMITTEE ON MEETINGS: A. W. Harrington, *Chairman;* Ralph B. Wiley, *Vice-Chairman;* W. D. Shannon, Gail A. Hathaway.

COMMITTEE ON RETIREMENT SYSTEM: I. V. A. Huie, *Chairman;* William J. Shea, C. E. Beam.

COMMITTEE ON SECURITIES: George W. Burpee, *Chairman;* R. R. Rumery, *Vice-Chairman;* E. M. Van Norden.

COMMITTEE ON MEMBERSHIP GRADES: Dean G. Edwards, *Chairman;* V. T. Boughton, *Vice-Chairman;* R. L. Forshay, J. M. Kennedy, Albert Haertlein, *Contact Member.*

COMMITTEE ON RESEARCH: B. A. Bakhmeteff, *Chairman;* Thorndike Saville, *Vice-Chairman;* F. A. Marston, A. E. Cummings, W. M. Wilson, G. R. Rich, Roy W. Crum, *Contact Member.*

COMMITTEE ON LOCAL SECTIONS: R. M. Angas, *Chairman;* J. B. Babcock, 3d, *Vice-Chairman;* Fred C. Scobey, John H. Porter, H. C. Woods, *Contact Member.*

COMMITTEE ON JUNIORS: T. M. Lowe, *Chairman;* Edmund Wilkes, Jr., *Vice-Chairman;* E. E. Lustbader, D. W. Godat, John H. Gardiner, *Contact Member.*

COMMITTEE ON STUDENT CHAPTERS: G. B. Earnest, *Chairman;* E. A. Gramstorff, *Vice-Chairman;* C. P. Hazelet, F. B. Laverty, R. A. Marr, O. H. Koch, *Contact Member.*

COMMITTEE ON ENGINEERING EDUCATION. H. E. Wessman, *Chairman;* C. A. Mockmore, *Vice-Chairman;* W. J. Armento, Hale Sutherland, D. V. Terrell, *Contact Member.*

COMMITTEE ON REGISTRATION OF ENGINEERS: G. M. Shepard, *Chairman;* H. T. Person, *Vice-Chairman;* T. K. Legaré, Leo Odom, Albert Haertlein, *Contact Member.*

COMMITTEE ON PRIVATE ENGINEERING PRACTICE: C. A. Emerson, *Chairman;* A. J. Ryan, *Vice-Chairman;* John Cunningham, R. N. Bergendoff, H. H. Allen, William M. Piatt, *Contact Member.*

COMMITTEE ON SALARIES: A. M. Rawn, *Chairman;* S. B. Lilly, *Vice-Chairman;* Paul Weir, C. H. Mottier, Gail A. Hathaway, *Contact Member.*

COMMITTEE ON EMPLOYMENT CONDITIONS: Gail A. Hathaway, *Chairman* and *Contact Member;* C. W. Bryan, Jr., *Vice-Chairman;* C. D. Bowser, S. S. Green, Ernest Whitlock, H. M. Hill.

COMMITTEE ON NATIONAL AFFAIRS Malcolm Pirnie, *Chairman;* I. V. A. Huie, *Vice-Chairman;* R. B. Brooks.

COMMITTEE ON ENCROACHMENT: R. J. Tipton, *Chairman;* J. C. Stevens, *Vice-Chairman;* W. P. Creager, W. A. Smith, Harrison P. Eddy, Jr.

COMMITTEE ON BUDGET: George W. Burpee, *Chairman;* Roy W. Crum, I. V. A. Huie.

COMMITTEE ON INTERNATIONAL RELATIONS—EJC: Thorndike Saville.

News of Local Sections

Coming Events

Central Ohio—Dinner meeting at the Chittenden Hotel, Columbus, February 20, at 6 p.m.

Cincinnati—Meeting in the Engineering Society Building, Cincinnati, February 5, at 8 p.m. Annual joint meeting of all societies in the Technical and Scientific Societies Council, February 11, at 8 p.m. David Sarnoff, president of RCA, will be the speaker.

Dayton—Luncheon meeting at the Engineers' club of Dayton, February 17, at 12:15 p.m.

District of Columbia—Business meeting in the Cosmos Club Auditorium, Washington, D.C., February 18, at 8 p.m.

Florida—Dinner meeting at the Seminole Hotel, Jacksonville, February 13, at 7 p.m.

Los Angeles—Dinner meeting at the Los Angeles Athletic Club, Los Angeles, February 12, at 6:30 p.m.

Metropolitan—Meeting in the Engineering Societies Building, New York, February 19, at 8 p.m.

Nashville—Dinner meeting at Mockers Restaurant, Nashville, February 6, at 6 p.m.

Northwestern—Dinner meeting at the Campus Club, University of Minnesota, Minneapolis, February 3, at 6:30 p.m. There will be a discussion on EJC.

Philadelphia—Annual social meeting at the Engineers' Club, February 15. Reception at 6 p.m.; dinner at 7 p.m.

Sacramento—Regular luncheon meetings at the Elks Club, Sacramento, every Tuesday at 12 noon.

San Francisco—Dinner meeting at the Engineers' Club of San Francisco, February 18, at 6 p.m.

Texas—Luncheon meeting of the Dallas Branch at the Adolphus Hotel, Dallas, March 3, at 12:15 p.m.; luncheon meeting of the Fort Worth Branch at the Blackstone Hotel, Fort Worth, February 10, at 12:15 p.m.

Toledo—Meeting of the Toledo Technical Council, sponsored by the Section, at the Doerman Theater, University of Toledo, Toledo, February 5, at 8 p.m.

Tri-City—Dinner meeting at the Blackhawk Hotel, Davenport, Iowa, February 6, at 6:30 p.m.

Virginia—Annual meeting at the Jefferson Hotel, Richmond, February 14. Business meeting at 4:30 p.m.; dinner meeting at 7. ASCE President E. M. Hastings will be the principal speaker.

Wisconsin—Meeting in the ESM Building, Milwaukee, February 27, at 7:30 p.m. Dinner at 6:30 p.m., same place.

Recent Activities

BUFFALO

LT. COL. HARLAND C. WOODS, newly elected ASCE Director from District 3, led a discussion of the proposed increase in Society dues at the December luncheon meeting. The technical program for the occasion consisted of a talk by Lt. Col. William I. English on "Economic Principles of Large Government Projects," with special attention to flood control. New officers of the Section, elected at this meeting, are: Louis S. Bernstein, president; Harry M. Huy, vice-president; Richard T. Carpenter, secretary; and A. Stuart Collins, treasurer.

CENTRAL ILLINOIS

THE IMPORTANCE OF education on an international scale was stressed by Prof. Wilbur M. Wilson, ASCE Director for District 8, in a talk on "The Atomic Bomb in a Changing World," at the December meeting. Professor Wilson, who represented the Society at the Bikini tests, described his sojourn in the South Pacific and explained his views on the part America should play in world affairs during the present period of unrest. L. E. Philbrook has been elected president of the Section for 1947, and Ellis Danner, secretary-treasurer.

CENTRAL OHIO

HIGH-FREQUENCY WAVES or microwaves, particularly as applied to communication, were described by J. O. Perrine, assistant vice-president of the American Telephone and Telegraph Co., at a recent meeting of the Columbus Technical Council, of which the Section is a sponsoring group. According to Dr. Perrine, four valuable properties of the higher frequency waves are that they can be reflected (as in radar), they travel more nearly in a straight line, can be "funneled" in a definite direction, and are less affected by "static." Dr. Perrine illustrated his talk with several pieces of equipment, including a device that emits waves at a frequency of 10,000 megacycles.

CLEVELAND

ASCE DIRECTOR Frank C. Tolles attended two recent meetings and spoke on Society affairs, including the history of ASCE participating in Engineers' Joint Council. He also discussed the recent action of Akron members in taking steps to form a Local Section of their own, emphasizing the fact that it is the privilege of Society members to form a new Section from any area containing at least 25 corporate members if certain formalities are complied with. Technical speakers appearing at these sessions were S. Burns Weston, executive director of the Metropolitan Cleveland Development Council, and James M. Lister, freeways expediter for the City of Cleveland.

COLORADO

CERTIFICATES OF LIFE membership were presented to William B. Freeman and Porter J. Preston at the annual "Ladies' Night," which took place early in December. Entertainment for the occasion consisted of the showing of colored slides of the mountains of Colorado and surrounding areas. The accompanying lecture was given by Carl Blaurock. The 1947 officers for the Section are: Russell W. James, president; Alfred J. Ryan, vice-president; and Carl A. Gould, secretary-treasurer.

CONNECTICUT

ONLY A SMALL percentage of the members of the Society take part in the professional programs and in ASCE activities for the advancement of the profession, Don P. Reynolds, assistant to the Secretary of the Society, told the members at a recent dinner meeting. Furthermore, Mr. Reynolds stated, only a relatively small proportion of the membership attends meetings or votes. The technical program for the occasion consisted of a talk on the organization and functioning of the Port of New York Authority, by Roger H. Gilman, assistant to the director of the Port Authority. Mr. Gilman also outlined the future plans of the Authority, which include the development of traffic facilities, a truck freight terminal, a bus terminal, a grain terminal, and the Newark Airport.

DAYTON

INSTALLATIONS IN WHICH different types of corrugated pipe are used were described by George Shafer, chief engineer of Armco Drainage and Metal Products, Inc., Middletown, Ohio, at a recent luncheon meeting. The first corrugated pipes were installed in 1898. Since that time numerous improvements have been made in the pipe, Mr. Shafer

said, with the result that it has a present life expectancy of 55 years. At another meeting, members of the Section heard Harry Price, of Price Brothers, Dayton concrete products manufacturers, discuss the design, manufacture, and installation of prestressed cylinder pipe. According to Mr. Price, two types are made. One consists of a concrete core in a 12-in. steel tube, wire being wrapped around the tube under tension, and a sand-cement mixture placed on the exterior to protect the steel from rust. In the second type, the steel tube is not used. Instead, the concrete is reinforced by prestressed steel rods and cast in vibrated form. The pipe is then prestressed by wire wrapping. New officers for the Section, elected at the December meeting, are: George Neuffer, president; William Macy, first vice-president; Charles Stephens, second vice-president; and Charles Black, secretary-treasurer.

DISTRICT OF COLUMBIA

THE SECTION GAVE its annual holiday party at the Cosmos Club late in December. Over 200 members and their wives and other guests enjoyed a social hour over cocktails.

FLORIDA

MEMBERS AND GUESTS attending the annual "Ladies' Night"—held in Jacksonville on December 12—were invited to express themselves in a spirited open forum on Section activities. The annual election of officers resulted in the choice of Harold D. Van Vranken for president, and Richard W. Cloues for secretary-treasurer. On December 19, the Section entertained at an informal dinner dance in honor of ASCE member, Col. Albert E. Jones, who is retiring from the Army Corps of Engineers after 28 years of active service.

GEORGIA

THE IMPORTANCE OF advance planning in the national economy as a safeguard against future recessions was emphasized by H. S. Sanders, assistant division engineer for the Bureau of Community Facilities, Federal Works Agency, in a talk at the January meeting. Mr. Sanders noted that, of the $75,000,000 Congress appropriated for advance planning, the city of Atlanta was allocated $60,000, for planning and design activities in connection with a proposed three-million-dollar highway improvement program complementary to the so-called Lochner Plan. Although the original appropriation has been entirely spent, Mr. Sanders stated, there remain a large number of worth-while projects in the state, for which planning studies are urgently needed. New officers for the Section are: Robert O. Harris, president; Van Porter Enloe and Jack G. Beacham, vice-presidents; and Melvin R. Williams, secretary-treasurer.

ILLINOIS

A FEATURE OF the annual dinner meeting—held in Chicago on December 11—was the presentation of certificates of life membership to Julius R. Hall, Andrew H. McDougall, and George A. Quinlan. The election of new officers resulted in the choice of L. R. Howson for president; C. H. Mottier, vice-president; and C. R. Ege, treasurer. George S. Salter and A. L. R. Sanders remain for another year as vice-president and secretary. Principal speakers for the occasion were A. E. Cummings, of the Raymond Concrete Pile Co., and Ralph B. Peck, research associate professor of soil mechanics at the University of Illinois. They discussed soil conditions in the Chicago area.

IOWA

C. M. STANLEY, consulting engineer of Muscatine, Iowa, led a discussion of engineers' fees and salaries at a joint meeting with the Iowa Engineering Society on January 8. The discussion was based on the report on fees and salaries, prepared by a committee of the Iowa Engineering Society, of which Mr. Stanley is chairman.

ITHACA

THE INFLUENCE OF new materials on future design was described by F. R. Benedict, manager of the industrial engineering department of the East Pittsburgh works of the Westinghouse Electric Corp., at a recent joint meeting in Elmira. Participating groups were the Steuben Area Chapter of the New York State Society of Professional Engineers and the Ithaca sections of the Founder Societies. Mr. Benedict showed samples of various materials, such as light alloys, plastics, and insulating materials, and explained their influence on the manufacture of new products, with regard to conservation of space and weight.

KANSAS

THE 1947 LEGISLATURE will be asked to pass an act providing for the compulsory licensing of professional engineers in Kansas, Prof. C. H. Scholer, of Kansas State College, stated at the December dinner meeting. Professor Scholer, who is chairman of a committee of three appointed by Kansas engineers to draft a proposed bill, pointed out that Kansas is one of four states that do not have a compulsory licensing law. In 1931 the legislature passed an optional registration law, under which more than 600 engineers have been registered to date.

KANSAS CITY

REPORTING ON THE feasibility of forming local technical divisions, R. G. Kincaid told members attending the December meeting that a canvass of the Section membership shows considerable interest in technical division work at Local Section level. It was decided that, while the formation of such divisions will be agreeable to the Section, the matter of organization will be left to the interested groups. New officers, elected at this meeting, are: Samuel J. Callahan, president; Ansel N. Mitchell and Mark C. Culbreath, vice-presidents; and Josef Sorkin, secretary-treasurer. The showing of a film, depicting the development of wrought iron manufacturing processes, concluded the evening.

KENTUCKY

FUNCTIONS AND AIMS of the Engineers Joint Council were outlined by ASCE Director Frank C. Tolles at the annual dinner meeting, which was held in Louisville on December 6. Mr. Tolles also commented briefly on the financial problems of the Society, and presented a certificate of life membership to W. J. Carrel. The principal technical speaker was B. E. Payne, chief engineer of the Louisville Water Co., whose talk on the company's Crescent Hill plant supplemented an afternoon inspection trip preceding the meeting. Section officers for 1947 are: S. M. Bailey, president; T. H. Cutler, vice-president; W. R. McIntosh, secretary-treasurer; and H. B. Lewis, corresponding secretary.

LOS ANGELES

THE ANNUAL "LADIES' Night" was celebrated recently at the Lakewood Country Club in Long Beach. The program, which was sponsored by the Junior Forum, consisted of a dinner with entertainment, followed by dancing and cards. A feature of the occasion was the presentation of the Section's award of Junior membership in the Society to Elliot Stephenson, recent graduate of the California Institute of Technology.

MARYLAND

GUESTS OF HONOR and speakers at the December meeting were W. R. Glidden, ASCE Director from District 6, and Executive Secretary W. N. Carey. Mr. Glidden gave an account of his stewardship since election to office and reported on the condition of Society finances and the need for increasing the membership. He was followed by Colonel Carey, who outlined the history and activities of EJC and explained its plans for the future. A lively discussion followed his remarks, with interest centering in the existing labor laws and their effect on the engineering profession. The constitution of the proposed Engineers Joint Council of Maryland, which had previously been mailed to the entire Section membership, was then submitted for debate and passed unanimously. During the evening, certifi-

LT. GEN. RAYMOND A. WHEELER, Chief of Engineers, speaks (upper photograph) at annual banquet of Mid-South Section, held in Memphis, Tenn., December 6. Seated at left of speaker is Maj. Gen. Max C. Tyler, M. ASCE; at right, Mrs. G. W. Miller, Col. K. D. Nichols, ASCE Director H. F. Thomson, Mrs. Calloway Allen, and Robert Brooks, M. ASCE. Standing left to right, in lower photograph, are newly elected officers of Mid-South Section: Henry W. Dougherty, of Memphis, secretary-treasurer; Garner W. Miller, of Memphis, president; and John Strom, of Little Rock, Ark., vice-president.

cates of life membership were presented to Robert Lacy, J. V. Hogan, and W. W. Pagon. New officers for the Section are: Robert M. Reindollar, president; S. Boyd Downey, vice-president; and Bruce A. Herman, secretary-treasurer.

METROPOLITAN

KEYNOTING HIS JANUARY 8 address before 300 members of the Section on "Pressure-Treated Wood—A Distinctive and Modern Structural Material," Ralph H. Mann, Eastern engineer representative of the Service Bureau of the American Wood Preservers Association, observed that pressure-treated timber is a distinct and separate material of construction. "It should be designed, specified, handled, and installed as such," he said. "It should not be confused with untreated wood. To obtain optimum economy in its utilization, three basic factors concerning pressure-treated piles and timber are the criteria. These are the species selected, the type of preservative to be used, and the amount of preservative to be impregnated into the wood. For adequate results the material must be properly treated in accordance with the standard specifications of the industry. It must be adequately penetrated with the specified amount of the proper preservative for the particular purpose or condition of exposure in which it is to be used; and of course the wood itself must be of a suitable sound grade of a treatable species at the time of treatment."

On January 6, the Section was host at a cocktail party in honor of the new Life Members in the area. A number of officers and members of the Section were present, and 20 Life Members received their certificates.

MIAMI

BANNING OF AUTOMOBILE parking in downtown Miami's main thoroughfares was described as a necessity to alleviate traffic congestion by Ben Friedman, former county engineer, at the December meeting. Mr. Friedman pointed out that new parking facilities must be provided elsewhere either by private interests or by the city. Speaking at the same meeting, Earl J. Reeder, city traffic engineer, stated that the proper flow of traffic should be given first priority in consideration of the traffic problem. Loading zones and taxicab stands should be taken next in order, before allocation of parking spaces for private cars, he added. Claude F. Wertz was elected president, and William C. Gorman secretary-treasurer.

MICHIGAN

ENGINEERS COULD DO much to improve living conditions, particularly as regards housing, if they could develop sociological and public relations techniques comparable to their ability to blueprint civic improvements, according to Anthony Weitzel, Detroit columnist and radio commentator, in a talk before the December dinner meeting. Certificates of life membership were presented to William H. Adams, A. J. Decker, Robert H. Merrill, George C. Newton, Charles W. Spooner, and Charles E. Stilson. Officers for 1947, elected during the meeting, are: T. C. Hanson, president; F. N. Menefee, first vice-president; George Hubbell, second vice-president; and L. V. Garrity, secretary-treasurer.

MID-MISSOURI

MEMBERS OF THE Student Chapter at the University of Missouri were in charge of the program for the December 7 meeting. Elbridge Morrill discussed the wide field of modern sanitary engineering, and Dallas D. Vance described civil engineering research projects under way at the University of Missouri. Both are members of the Student Chapter. The final speaker was Prof. Ralph H. Peck, who gave an illustrated talk on methods used in obtaining and transporting rubber from the Brazilian jungles. In a talk before a joint meeting with the Rolla Chapter of the Missouri Society of Professional Engineers—held at Rolla on December 17—Keith Anderson discussed engineering in ground-water studies. Mr. Anderson, who is water engineer for the Missouri State Geological Survey, emphasized the problems that are being created locally by industry, which depletes ground-water reserves.

NEBRASKA

SPEAKING ON "THE New Economics" at the December meeting, Prof. Roderic B. Crane, of the University of Omaha, discussed theories currently influential in our government. There was also a review of EJC activities—given by Eldon B. Matthauser—and a discussion of the Kansas City Local Section Conference. As an outcome of the discussion, the Sec-

tion went ". . . on record as being in favor of amending the Wagner Act so as to exclude from its provisions all professional employees, including professional engineers . . ." and petitioned the "ASCE to use all its influence in attempting to bring about such an amendment."

NORTHEASTERN

PRINCIPAL SPEAKER AT a recent meeting was Crocker Snow, director of the Massachusetts Aeronautics Commission, who described the National Airport Program and its relationship to the Section. A discussion of the aims and activities of EJC—headed by Arthur Shaw—concluded the program.

NORTHWESTERN

THE $200 SCHOLARSHIP, awarded annually by the Section to an engineering student in his senior year at the University of Minnesota, was presented to Archie Johnson at the annual meeting on December 2. Election of officers for 1947, held at this time, resulted as follows: Edwin M. Grime, president; Harry L. Wilson, first vice-president; Edgar A. Goetz, second vice-president; and Frank S. Altman, secretary-treasurer. A talk on "Professionalism in Engineering"—by S. L. Stolte, president of the Minnesota Federation of Engineering Societies—comprised the technical program at the January meeting. Harry L. Wilson, Section representative at the Kansas City Meeting, reported on the Local Section Conference.

PHILADELPHIA

PUBLIC WORKS IN Philadelphia, as now under way and as proposed for the immediate future, were outlined at the January 14 joint meeting with the local chapter of the American Public Works Association. Following a general description of the Philadelphia Department of Public Works and its improvement program—given by Thomas Buckley, director of public works—a number of city engineers and officials discussed the program in detail. The speakers were: Dudley T. Corning, chief of the Bureau of Highways and Street Cleaning; A. Zane Hoffman, chief of the Bureau of Engineering, Surveys and Zoning; Elbert J. Taylor, chief of the Bureau of Water; Edwin R. Schofield, principal assistant engineer of design; J. Victor Dallin, chief of the Bureau of Aeronautics; and Samuel S. Baxter, projects engineer of the Bureau of Engineering, Surveys and Zoning.

PITTSBURGH

THE INFLUENCE OF river improvements on industrial growth in the upper Ohio River valley was described by Lt. Gen. Raymond A. Wheeler, U.S. Chief of Engineers, at a joint dinner given in his honor on December 17. Sponsoring groups, in addition to the Section, were the Engineers' Society of Western Pennsylvania, the Propeller Club, and the Pittsburgh post of the Society of American Military Engineers. A capacity audience of 432 heard General Wheeler.

PROVIDENCE

ROBERT E. WHITE, engineer-in-charge for Spencer, White & Prentis, discussed foundation problems encountered by his company in the construction of the New Peoples' Savings Bank in Boston, at the December meeting. According to Mr. White, plans for the building stipulated a boiler room floor level 27 ft below the sidewalk and considerably lower than the foundations of adjoining buildings. Borings showed the necessity of using piles to support the foundations of the older structures too. Another complication, the speaker stated, was the necessity of working in a very narrow space, 42 ft between walls, without undue disruption of traffic on the busy thoroughfares at each end.

SACRAMENTO

CALIFORNIA'S TOPOGRAPHIC MAPPING program was described at a recent luncheon meeting by Robert L. Wing, associate hydraulic engineer in the California Department of Public Works. Mr. Wing discussed the history and status of mapping in California, and explained the cooperative program being carried out by the state, the U.S. Geological Survey, and other agencies. The presentation of certificates of life membership—to Albert Givan, D. R. Cate, S. A. Kerr, and G. G. Pollock—was the feature of another of the meetings. High light of the December meetings was the twenty-third annual Christmas Jinx, "an amateur entertainment put on with professional skill by members of the Section, who for this one day were willing to portray themselves as other engineers see them."

ST. LOUIS

"NEW NATIONAL SOCIETY Policies" were outlined by ASCE President W. W. Horner, guest of honor at the annual dinner meeting. The other guest speaker was Dr. Carey Croneis, who gave an illustrated talk entitled "Ancient Background for Modern Conflict." Dr. Croneis advanced the theory that the various natural resources necessary for making war have been the real causes for war by aggressor nations, and that the location of these resources has been the determining factor in the course of history. During the evening, certificates of life membership were presented to William H. Vance, Walter L. Smith, Peter A. McLeod, and Walter J. Knight. New officers, elected at the meeting, are: John I. Parcel, president; Walter R. Crecelius, vice-president; and Henry S. Miller, secretary-treasurer.

ROCHESTER

ASCE DIRECTOR S. C. HOLLISTER attended a recent meeting and led a discussion on Local Section interests and activities. Dean Hollister also spoke informally on the organizational set-up of the Society and described ASCE participation in EJC. Following an annual custom, the Section is cooperating with the Rochester Engineering Society in arranging a series of luncheon meetings. Speakers have included Norman H. Davidson, industrial engineer for the Rochester Gas and Electric Corp.; W. Earl Weller, director of the Rochester Bureau of Municipal Research; and Kenneth Knapp, city engineer of Rochester. Sponsorship of the luncheon meeting of the Rochester Engineering Society is shared each year by all the affiliating societies, each group having charge of the programs for a month.

PRESIDENT OF MONTERREY ENGINEERING SOCIETY, J. Maiz Mier, addresses Monterrey, Mex., joint meeting of his organization and Texas Section, in upper photograph. To his right are Mrs. Hans Helland, of San Antonio, and C. M. Blucher, new president of Texas Section. Below, ASCE Director Oscar Koch and Executive Secretary Carey pause during engineer inspection of brewery at Monterrey on November 23.

SAN DIEGO

A SPECIAL MEETING to consider the proposed Professional Engineers Act was held in December. After discussion of the subject, the Section's delegate to the State Legislative Committee was instructed to inform the committee that, in the opinion of the Section, the act does not protect civil engineers. However, the Section will give the act further consideration when it is rewritten to protect engineers and surveyors. At another meeting, Philip Helsley, vice-president of the Section, spoke on the practical approach to concrete design and control.

SAN FRANCISCO

ADDRESSING THE ANNUAL meeting on "Our Place in the World," H. J. Brunnier, San Francisco consultant, evaluated the role of the engineer in modern life, and challenged the younger engineers to do their part to maintain the standards of the profession. Officers for 1947, elected at the meeting, are: S. T. Harding, president; L. A. Elsener, second vice-president; and J. E. Rinne, secretary-treasurer. The capacity attendance of 220 included a number of Student Chapter members and 25 recipients of certificates of life membership.

Members of the Junior Forum recently heard T. Y. Lin speak on civil engineering developments in China. Mr. Lin is assistant professor of civil engineering at the University of California.

SPOKANE

SIGNIFICANT CHANGES IN the political complexion of the Washington State Legislature were described at a recent meeting by ASCE Vice-President William D. Shannon, who was elected to the legislature in the fall elections. Mr. Shannon also discussed current Society problems and outlined recent EJC activity in the field of collective bargaining. The rest of the evening was devoted to discussion of the Washington State Engineers Licensing Law, with a view to proposing modifications of the law.

SYRACUSE

A TALK ON the restoration of concrete structures—given by Joseph Lamprecht, consulting engineer of Syracuse—comprised the technical program at a recent joint meeting with the Technology Club of Syracuse. Earlier in the evening, members of the Section heard Richard G. Coulter and Earl F. O'Brien discuss the work of the Section's Committee on the Professional Development of Engineers.

TACOMA

ASCE VICE-PRESIDENT W. D. Shannon reported on the Kansas City Meeting of the Society at a recent dinner meeting, and outlined the organization and activities of EJC. Various changes in the Engineers' Registration Law now under consideration were discussed by Ralph W. Finke, Tacoma representative to the Puget Sound Council of Engineering and Technical Societies. The Section went on record as being in favor of holding to the model law, and a motion was made and approved that the Puget Sound Council's outline of suggested changes be submitted to a Section committee for study. A brief talk by Edward J. Drobnack, on assessment of costs and methods employed in expanding the Tacoma water-distribution system, concluded the program.

TENNESSEE VALLEY SECTION

THE DEVELOPMENT OF aviation in Tennessee was discussed by Prof. E. S. Fabian, director of the airport development laboratory at the University of Tennessee, at the January 8 meeting of the Knoxville Sub-Section. Professor Fabian reviewed the general history of aviation, cited possible handicaps to future development, and discussed national and state programs, with particular emphasis on current local activities. He illustrated his talk with slides showing airport layouts.

TEXAS

THE FUNCTION OF the National Labor Relations Board in the settling of labor disputes between employer and employee was described at the December meeting of the Fort Worth Branch by Dr. Edwin C. Elliott, regional director for the Board. The rest of the meeting was given over to a report on the fall meeting of the Texas Section, presented by Uel Stephens.

TOLEDO

GUEST OF HONOR and principal speaker at the annual meeting was C. C. Singleton, regional structural engineer for the Portland Cement Association at Philadelphia. Mr. Singleton supplemented his talk on "Recent Developments in Reinforced Concrete" with slides showing various types of structures which he identified for the audience. New officers for the Section are: Robert E. Brown, president; Harvey P. Jones, second vice-president; and Claire A. Shaler, secretary-treasurer. Samuel C. McKee automatically becomes first vice-president.

TRI-CITY

NEW FIELDS OF engineering are opened to the profession as a result of wars, and established fields, such as construction, are greatly expanded, I. A. Bickelhaupt, of the Byrne Co., Washington, D.C., told members of the Section. Addressing the December dinner meeting on "New Horizons for the Engineer," Mr. Bickelhaupt pointed out that new fields developing after World War I were aircraft and radio, and predicted that atomic energy and electronics will be among the fields developed as a result of the recent war. In the construction industry, he said, there will be signal expansion in the building of homes. Mr. Buckelhaupt is manager of a large housing project that the Byrne organization is constructing at Moline, Ill.

WISCONSIN

"HOW ABOUT THE JUNIORS?" This question attracted a number of young engineers to a recent meeting for Juniors, sponsored by the Section. Charles Yoder, secretary of the Section, led a lively discussion on such questions as: What can we gain from active membership? Where do we fit in the Society picture? Why should we participate more fully? Later the group saw a sound motion picture on railroading, and a smoker concluded the evening. Enthusiasm and interest were so great that it is hoped to make the Junior meeting an annual event.

Student Chapter Notes

THE CITADEL

SALIENT POINTS IN the purification and decontamination of water were shown in a moving picture—a presentation of the Cast Iron Research Corp.—at a recent meeting. The Citadel Chapter elected the following new officers at the meeting: D. H. Williams, president; J. L. Sadler, Jr., vice-president; Cadet T. C. Williams, secretary; and C. B. Graves, treasurer. All except Cadet Williams are veterans. Lt. Col. H. G. Hayne was chosen Faculty Adviser.

LEHIGH UNIVERSITY

WORK OF THE American Military Government in the redevelopment of the German public schools and in opening Heidelberg University was described by Dr. Earl V. Crum, of the Lehigh University staff, at a Christmas dinner meeting. Dr. Crum has been in charge of educational and religious affairs for the AMG in Germany. During the evening the following new officers were elected: C. N. Codding, president; K. W. Whitney, vice-president; J. T. Jacobson, secretary; and F. J. Slaby, treasurer. The party, which was held at the Sun Inn built in 1758, was enlivened by the presence of the wives and "dates" of the students.

UNIVERSITY OF ARIZONA

THE UNIVERSITY OF Arizona reports that it is having an interesting and active year, and that at present all are at work to make the student conference—to be held in conjunction with the ASCE Spring Meeting in Phoenix in April—a great success.

NEWS BRIEFS

ABOUT ENGINEERS AND ENGINEERING

$40,000,000 Housing Program Is Launched by Army Engineers

ARMY ENGINEERS HAVE been authorized by the War Department to initiate the 1947 Army construction program for Continental United States at a total estimated cost of $60,069,752. Approved by the Office of War Mobilization and Reconversion, the program differs radically, both in size and make-up, from those of the war years, when no family-type housing was constructed. The housing program, which accounts for $41,329,500 of the total, includes approximately 5,580 apartment-type units obtained by conversion of existing units, and 2,133 new temporary-type units.

Each of the apartment-type and temporary units provides housing for a member of the armed forces and his family and also relieves the adjacent territory of the necessity of housing them, and in many cases provides vacant units for veteran or other civilian families. The greatest part of the remaining $18,740,252 is allocated to construction required in connection with research projects.

On completion of its housing program, the Army will have made available approximately 15 percent of its requirements for family housing units. The permanent-type housing units authorized by Congress, and for which funds were appropriated in 1947, are not being constructed because of current economy measures and the shortage of building materials.

In the non-housing category, in addition to construction required for research projects, only certain projects essential to health, safety, education or necessary services are being authorized. The Army has a backlog of projects which are, or soon will be, essential to the efficient performance of its mission and which total over a billion dollars. The undertaking of any major portion of this program must, however, give precedence to civil construction needs until they return to normal.

Keokuk Dam's Thirty-Three-Year Service Record Reviewed

CONSTRUCTED IN 1910–1913, during era of "sloppy mix," Keokuk Dam on Mississippi River owes its longevity to massiveness of arches and gravity sections on which designer Hugh Cooper, M. ASCE, relied.

AMONG THE GREAT ENGINEERING structures in this country that have stood the test of time is Keokuk Dam, constructed in 1910–1913 at a rushing, turbulent point on the Mississippi River near Keokuk, Iowa.

Facts pertaining to the construction and operation of this dam over the past 33 years were presented in a paper read before a joint meeting of the Iowa Engineering Society, the Iowa Section of ASCE and the Engineers Club of Iowa City. The paper, titled "Keokuk Hydro—A Third of a Century Old," was presented by P. L. Mercer, plant manager, Union Electric Power Co., Keokuk, as part of the Iowa Centennial celebration. Some of Mr. Mercer's remarks are quoted from the Iowa Engineering Society *Proceedings*, October-November 1946, as follows:

"Keokuk was the first of the large man-built hydro developments and was so successful that it became the pattern to be followed in many later projects. I really have never ceased to marvel at how well Mr. Hugh L. Cooper and his associates planned and executed the dam and the hydraulic features of the power station, or what a fine job the Stone & Webster people did in the electrical installation and in the architecture of the building.

"Because the project was built on the rock rapids, its structures have the best possible foundations, and this factor alone meant much to its success. Built during the era when the best advice was that you could hardly use too much water in mixing concrete, the entire project was constructed of so-called 'sloppy mix.' Consequently, we have never been surprised at the extensive spalling of concrete surfaces which you can find over so much of the structures, but rather have been amazed at how well the great bulk of the concrete has stood up and has retained its strength and solidarity. Mr. Cooper, who was responsible for the dam and substructure of the plant, did not believe in the use of steel reinforcement. He relied on arches and gravity sections and I think perhaps this fact, resulting in heavy, bulky sections, was a beneficial factor contributing to the longevity of the structure, in spite of the extremely high water-cement ratio used in the mix.

"The concrete at, and near, the water line on both the upstream and downstream sides of the dam has weathered quite badly. Most of the damage, of course, has occurred during the winter months when freezing and thawing of the water-soaked concrete has spalled it in some areas to a depth of about 15 in. from the original surface. For the most part, however, where the concrete has been dry, or where it has been protected from freezing temperatures, all evidence indicates that it is in a very satisfactory condition.

"The powerhouse itself has given very little trouble and appears to be in very good condition for all its years of use. It is a large structure, almost 1,000 ft in length, 125 ft in width and over 100 ft in height. It was designed and built by Stone & Webster and is of typical monolithic reinforced concrete construction. The mix used, while wet, was better than that used for the dam and substructure, and being less exposed to moisture has resisted the weather much better. It continues to develop minor cracking in places, but we keep these repaired and at no time have we discovered any evidence of structural weakness. The many large steel sash windows have required more maintenance than any other part of the structure, though we have also had to give some attention to the roof, recoating it at intervals."

Equipment Distributors Plan Annual Convention

MATTERS OF ADAPTATION from a wartime to a peacetime status will predominate among the subjects discussed at the 28th Annual Convention of the Associated Equipment Distributors, February 13–15 in the Edgewater Beach Hotel, Chicago. These discussions will include problems involved in the disposal of surplus government-owned construction and road-building machinery, business administration, financing, and advertising.

Welded Steel Cages Tie-in Columns and Roof

WELDED steel cages are used for tie-in between tubular columns and the reinforcing structure of a roof in a building addition erected in Cleveland, Ohio. Architects: Cutting & Ciresi.

The reinforced concrete structure is 60′ x 182′ with a wing 105′ wide. So that another floor may be added later, the roof is heavily reinforced to take 400 lbs. per sq. inch.

Details of the welded steel cage and the top of the tubular column are sketched in Fig. 1. The cages are made of ¾″ round reinforcing bars, formed into rectangles and butt

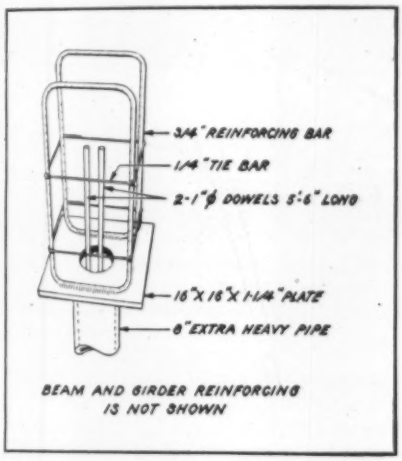

3/4" REINFORCING BAR
1/4" TIE BAR
2-1"ϕ DOWELS 5'-6" LONG
16"X 16"X 1-1/4" PLATE
8" EXTRA HEAVY PIPE
BEAM AND GIRDER REINFORCING IS NOT SHOWN

FIG. 1

welded. These rectangles are tied together with ¼″ tie rods, tack welded to the bars.

Fig. 2 shows how the steel cages are welded, on both sides of each leg, to the top plate of each column by a 4″ fillet weld using 5/16″ "Fleetweld 5" electrode.

The tubular columns are 8″ diameter, extra-heavy pipe. Plates measuring 16″ x 16″ x 1¼″ are shop-welded to the column ends with a ¼″ fillet all around.

The building has ten columns 17′-10″ long and two which are 21′-8″ long.

Fig. 3 shows one column and steel cage, and the framework used to support forms for concrete girders,

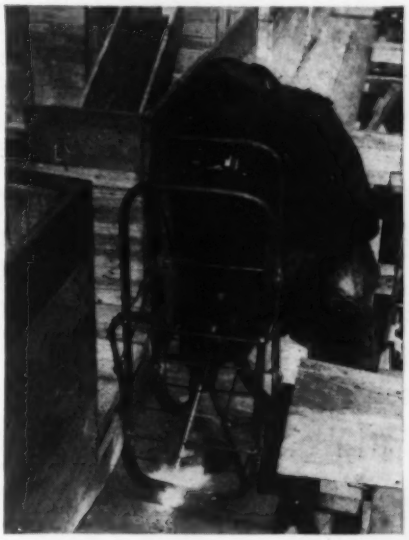


FIG. 2

beams and floor slabs.

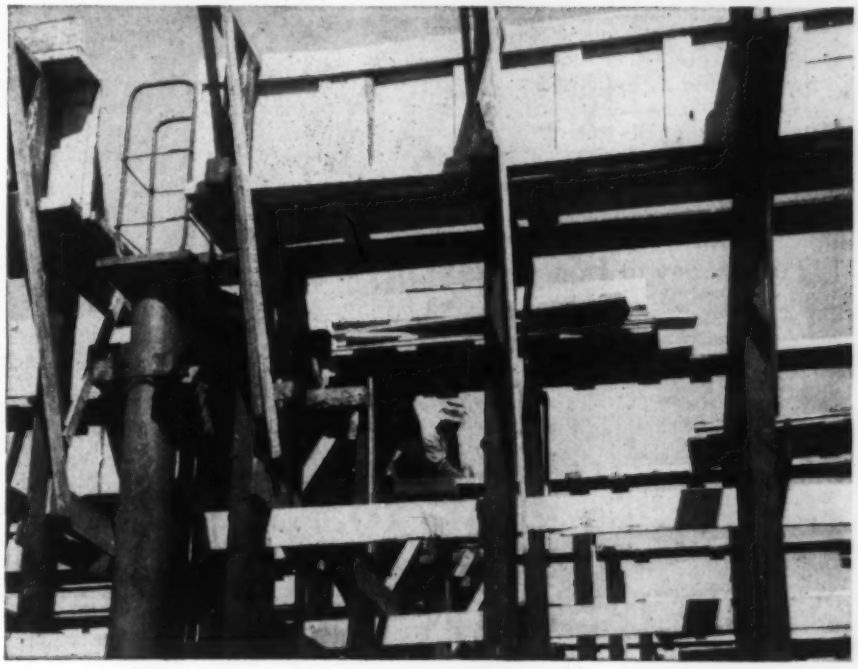
Fig. 4 shows roof during a later stage of construction with reinforcing bars for girders and beams in place, ready for placing of concrete.

The reinforced concrete girders are 28″ deep and are haunched down at the columns. Reinforcing bars in girders are 1⅛″ square and those in the beams are 1″ round. Strap iron frame shown in center of picture will have anchor bolts through the four holes for future second-floor column.

The Lincoln Electric Company for years has been publishing a series of Studies in Structural Arc Welding. These may be obtained by writing to THE LINCOLN ELECTRIC COMPANY, Dept. 271, Cleveland 1, Ohio.

FIG. 4

FIG. 3



1947 Production of Building Materials Will Meet Demand, FWA Predicts

BUILDING MATERIALS AND EQUIPMENT for public construction should be more plentiful in 1947, the Federal Works Agency reports, basing its conclusion on an analysis of production rates, trends in manufacturers' inventories, and the level of construction activity. FWA estimates the total 1947 volume of public and private new construction and maintenance at 19.3 billion dollars, and new public construction alone at 2.4 billions.

Although residential construction will get its fill of the material supply, in many instances it will not draw heavily on the materials employed in public works. For example, housing will require relatively little of the supply of structural shapes, steel reinforcing, cement, aggregates, terra cotta tile, pressure pipe, rigid steel conduit, etc.

Brick, too, should be available in ample supply for public construction. Estimates of the 1947 brick supply indicate that, even after the needs of the $1^1/_2$-million-unit housing goal have been met, about 3 billion brick will remain for other public and private construction. This is equivalent to about 85 per cent of the average yearly production for the five-year period 1935 through 1939.

The total demand by public activity for such items as lumber, gypsum board, concrete block, cast-iron soil pipe, etc., will be relatively small. In the mechanical field the competition is also comparatively light. Housing demands a distinct type of equipment, usually designed for light loads and low capacity.

Although indications are that, for most materials, 1947 production will keep abreast of demand, low inventories will cause some spot shortages and consequent delays in procurement of even relatively small quantities. It is therefore important that public officials carefully investigate the local problem with regard to the supply of specific materials in order to minimize delays in construction according to FWA.

Elimination of Unnecessary Specification Costs Urged by Highway Groups

IN A MOVE towards reduction of highway construction costs, the Joint Cooperative Committee of the American Association of State Highway Officials and the Associated General Contractors of America, at its meeting December 16 in Los Angeles, recommended that both the AGC and the AASHO at their conventions study unnecessary costs incurred in highway specifications.

Meeting in conjunction with the annual convention of the AASHO, the committee stated in a resolution that it had carefully studied needlessly costly practices in highway construction which "involve a considerable amount of unnecessary labor costing the contractor and the public beyond all proportion to the advantages received."

Points emphasized in general were: (1) Certain refinements can be eliminated in so far as contractors will cooperate by satisfactory work; (2) specifications writers would do well to outline such tolerances as can be obtained by use of machinery only and without expensive hand labor; (3) further progress on the problems of unnecessary refinements can be made and the highway dollar conserved by intensive study on the state and local level between representatives of AGC groups and highway officials.

Particular reference was made to certain practices on secondary and farm-to-market roads under the Missouri State Highway Department and approved by the Public Roads Administration, such as elimination of hand-rubbed concrete surface finish, more liberal tolerances definitely set forth, 90 percent compaction of fills instead of 95 percent, and revised segregation of items of work, such as lineal mile grading under certain conditions.

C. M. Hathaway, M. ASCE, engineer of construction, Illinois Division of Highways, who presided at the meeting, announced that a special subcommittee will resume a study of general provisions in specifications.

Worthwhile suggestions for reducing unnecessary costs were reported forthcoming from contractors in many states. It was the sense of the meeting that encouragement of better liaison between contractors and engineers is a "must" program of local AGC groups as a matter in the public interest.

Massachusetts Adapts Aerial Photography to Highway Use

(*Continued from page 86*)

and the proximity of schools, golf courses and cemeteries. Frequently, soil types can be determined on the pictures, and areas presenting design difficulties can be avoided. The existing topographic maps, on the other hand, do not indicate land use, give very little information about the types of buildings, and in some of the cities show only what are known as "landmark buildings."

2. The photograph is much easier to read than a map. In condemnation proceedings the layman can understand an aerial photograph and reach a fair decision while a topographic map only confuses him.

3. Aerial photographs are at three to six times as large a scale as the existing maps. This fact is of great assistance in planning highways.

4. Pictures taken before and after highway construction are valuable exhibits in damage suits because they show exactly what portions of a property are damaged or destroyed during construction.

5. Property acquisition is simplified and expedited when aerial photographs are available. Boundaries surveyed in 1741 in the town of Petersham, Mass., can still be traced on pictures taken today. In similar cases, the work of the survey party in recovering old lines is found to be much easier.

6. Cost of location survey is reduced.

7. Pictures are of assistance in construction work, since in many cases the location of gravel and other construction material can be determined right on the photograph without going into the field.

In conclusion, the writer is convinced that in rugged, heavily wooded terrain where the line cannot be fairly definitely determined, an aerial topographic map is accurate enough to determine the final location of a line and is faster and more economical than the usual ground reconnaissance survey methods.

Another paper in this symposium was presented by Spencer Miller, Jr.

Positions Are Open in Norfolk Engineer District

CIVIL ENGINEERS AND DRAFTSMEN in the categories P-3, P-4, and SP-8 are needed to fill vacancies in the General Engineering Division, Design Section, Norfolk Engineer District.

Applicants in the P-3 category must be graduates in civil engineering from a college or university of recognized standing and have had at least three years of professional experience in engineering, including at least one of important work in design. In the P-4 category at least five years of experience are required, including one in design or specification writing on work requiring resourcefulness and initiative. Structural draftsmen, in the SP-8 category, must be graduates of an accredited high school and must have had at least five years of drafting experience, able to develop finished detail construction drawings from designers' sketches. Substitution of education for experience, according to the usual provisions, is permissible.

Applicants should furnish completed Application for Federal Employment, Standard Form 57, to the Placement Section, Personnel Branch, U.S. Engineer Office, P.O. Box 119, Norfolk 1, Va., indicating lowest acceptable salary and earliest date available. Standard Forms 57 can be secured from any U.S. Civil Service Office, any first or second-class postoffice. Applications should be mailed promptly as it is necessary to fill vacancies by February 15.

French Engineers Show Friendship for U.S. Group

DORMANT DURING THE WAR, the Society of Professional Engineers of France has again become active. One of its new activities is the publication of a quarterly, *La Technique Appliquée*, the first issue of which features an illustrated translation of D. B. Steinman's article, "Beauty in Bridges."

In 1940 the French society indicated its cordial relations with the National Society of Professional Engineers (U.S.) by electing five past officers of the latter organization to honorary membership. The men so honored are: John C. Riedel, Samuel Sacks, Arthur V. Sheridan, and D. B. Steinman, Members ASCE; and Perry T. Ford.

● "The impossible takes a little longer"... this is one way of saying that the draftsman lets no out-worn conceptions restrict his creative ideas. Yet without his specialized technique for expressing ideas on paper, the designs he creates could scarcely be turned into substance. As the draftsman relies on his own hands and eyes, he calls likewise on his drafting instruments to serve him functionally. So integral a part of his technique do they become, they are virtually his partners in creating.

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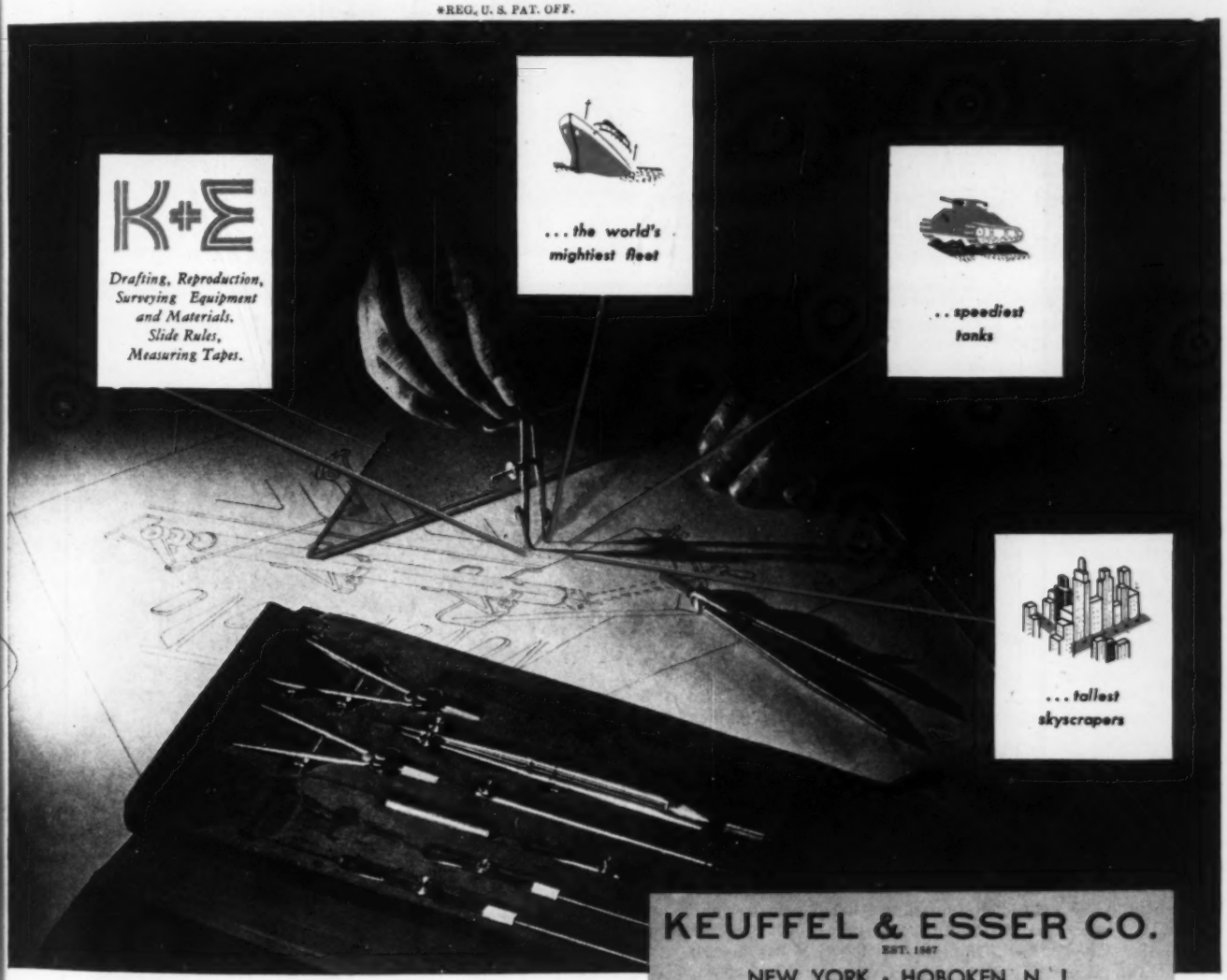

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Use of Heavy Equipment in Soil Compaction Described

AS A CONTRIBUTION to the sound construction of airports and highways, the American Road Builders' Association has issued Technical Bulletin 109, consisting of a report on "The Use of Heavy Equipment for Obtaining Maximum Compaction of Soils," by O. J. Porter, M. ASCE, and a paper on "Vibratory and Impact Compaction of Soils," by Gregory P. Tschebotarioff, M. ASCE, director of the Soil Mechanics Laboratory at Princeton University. Both reports were presented at the forty-third annual meeting of the Association.

Engineers wishing to obtain copies of the 31-page, illustrated bulletin should get in touch with the American Road Builders' Association, 1319 F Street, N.W., Washington 4, D.C.

Boston Engineers Design Alaskan Air Defenses

UP IN THAT "ice-box appendage" of the nation—Alaska—a program involving the expenditure of $100,000,000 is under way to build up Uncle Sam's air defense in the Arctic. The ideas, the planning, the specifications and all the figure work for this great expansion development come from the minds of more than 100 engineers and draftsmen who labor over drawing boards and desks on the 11th floor of the Chamber of Commerce Bldg., at 80 Federal St., Boston.

The Alaskan project is under the direction of Fay, Spofford & Thorndike, architectural and engineering firm—old hands at air-base construction in the Arctic regions during the war. Among the concern's achievements are listed construction work for the Army Air Forces at Harmon Field, Stephenville, Argenta, Fort Pepperell at St. John, Newfoundland; Goose Bay in Labrador, and the bases near the Greenland icecap. All told, this organization has built 13 air bases in Arctic regions.

Partner-in-charge is Carroll A. Farwell, M. ASCE, and the chief engineer is William L. Hyland. In an interview with Arthur A. Riley of the *Boston Daily Globe*, Mr. Hyland said: "We are making these bases, which were rather hurriedly constructed during the war, permanent airfields. Runways are being extended to accommodate the new huge B-36 type of bomber aircraft, and much of our effort is devoted to the building of permanent housing for Army personnel."

1947 Quarterly Meetings Are Scheduled by ASME

DATES AND PLACES have been fixed for the 1947 quarterly meetings of the American Society of Mechanical Engineers.

The spring meeting will be held in Tulsa, Okla., March 2–5; the semi-annual meeting in Chicago, June 16–19; the fall meeting in Salt Lake City, Utah, September 1–4; and the annual meeting in New York City, December 1–5.

R. Robinson Rowe, M. ASCE

"I'VE HEARD," said Professor Neare, "that the Draftsmen's Union is tremendously interested in Guest Professor Steinmance's problem in drafting efficiency. If their work can be done with *either* a tri-

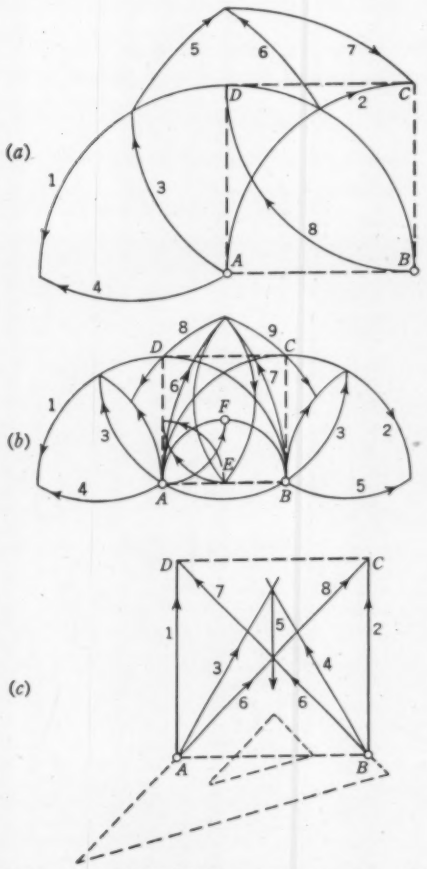

FIG. 1. A SQUARE is plotted in *(a)* and *(b)* by compass and in *(c)* by 30–60 deg triangle.

angle or a compass, then they shouldn't be asked to own *both*. Moreover, they may have a clear case for retroactive double time way back to 1938 if they have been duped by capitalistic engineers into using these instruments simultaneously. That would dwarf the portal-to-portal suit."

"They forget the drafting machine," retorted Professor Steinmance. "Our problem was not to find the easiest way to plot a square, but whether it was easier to use a compass alone or a 30–60-deg triangle alone. Answers are in order."

"I say the compass, because I couldn't do it with a triangle," was Joe Kerr's bid. "In the sketch (Fig. 1*a*). Points *A* and *B* of square *ABCD* were given and numerals on the arcs show the order in which I drew them."

"We were asked to plot the center of the square, too," reminded Ken Bridgewater. "Joe would have to bisect a diagonal to finish the construction. I prefer my method (Fig. 1*b*), because it shows how to bisect a line segment *AB* at *E*" and find the center at *F*."

"Nice symmetry, too," conceded Professor Steinmance, "but, Ken, did you agree with Joe that the compass is easier?"

"Positively," said Ken.

"Then I'll have to show them a trick," gloated Cal Klater. "The points can be found with the triangle in only 8 moves (Fig. 1*c*). The tricky move is the sixth, when the center of the square is found by sliding the 90-deg vertex along the fifth line and one leg along *A* until the other leg falls on *B*."

"Uncanny, Cal. Incidentally, the young draftsman wasn't smart enuf to find that construction, but he was too smart to use the compass method. He bought a 45-deg triangle."

"Thanks for an interesting teaser," said Professor Neare. "The Club may be interested to try other triangle constructions in Professor Steinmance's repertoire—that is, erecting a regular pentagon on a given side, or constructing a triangle from three given sides. But for a new problem, aimed at the compass adherents, I am calling on Guest Professor Josh Kidder."

"You won't believe this really happened, Noah, but when I was timber cruising in Death Valley in 1895, I ran across some old ruins, including three stone columns still in place. From their positions I guessed they were the northern and two southernmost of a regular nonagon plan. On a hunch that a tomb or treasure had been buried at the center, I located it with my tape, which was just long enuf to reach from the north to either south column. If the Club can tell me how I did it, I'll tell them what I found at the center."

[*Cal Klaters were Richard Jenney, Anne Othernut (J. Charles Rathbun), Verne Alexander, Robert M. Dodds, Edward W. Raymond, Ernest P. Goodrich, D. Sy Ford (Allan M. Newman) and Isidore Knobbe (Joseph S. Lambie). Guest Professors were D. B. Steinman and Henry Kuphal, respectfully.*]

Firm Celebrates 70 Years of Construction Progress

TO CELEBRATE ITS 70th anniversary in the general contracting field, the Pittsburgh firm of Booth & Flinn has issued a handsomely illustrated review of its major construction accomplishments. The company's diversified range of heavy and light construction includes such notable projects as the George Washington Memorial Bridge at Pittsburgh; the Holland Tunnel under the Hudson at New York; and industrial and marine installations for the Carnegie-Illinois Steel Corp., the Bethlehem Steel Co., and the Dravo Corp.

Inquiries regarding this 93-page book should be addressed to Booth & Flinn Co., 1942 Forbes Street, Pittsburgh 19, Pa.

ALLIS-CHALMERS *First Again*

NOW WITH 1,000 HOUR LUBRICATION

Truck Wheels
Front Idlers
Support Rollers

GREASING JOB IS EASY FOR THIS OPERATOR

. . . no fighting through mud to reach truck wheels, front idlers and support rollers! With Allis-Chalmers' 1000-hour truck assembly lubrication, operator can select convenient time and spot to replenish lubricant.

"GOODBYE" to old-fashioned, expensive, time-consuming tractor maintenance methods.

NOW . . . truck wheels, idlers and support rollers on all Allis-Chalmers crawler tractors are GREASE-PACKED at the factory. Lubricant needs only to be replenished . . . not replaced . . . once every *1,000 hours*. That's . . . ONCE IN SIX MONTHS . . . on a 40-hour week basis! This long interval is made possible by taking full advantage of the improved Positive Seal, *exclusive in A-C tractors*.

What it means! Relieves you of the responsibility of frequent lubricating attention . . . results in less down time for greasing or repairs . . . considerably reduces lubricant cost . . . adds a factor of safety by assuring adequate lubrication for long operating periods. Result — your maintenance cost is reduced and tractor operating life extended.

For the full story of this and other features which make Allis-Chalmers tractors steady, high yardage movers, contact your Allis-Chalmers dealer.

ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

International Order for Standardization Organized

DELEGATES FROM 25 nations met in London recently to form an International Organization for Standardization (ISO), the membership of which will consist of national standards bodies. The work of ISO will be enacted through technical committees upon which any country that so desires may be represented.

Although the new ISO organization will not be formally completed until its constitution is ratified by 15 national standards bodies, it has started work by reviewing the projects of its two predecessor organizations—the International Federation of National Standardizing Associations and the United Nations Standards Coordinating Committee. Headquarters of the new organization will be in Geneva, Switzerland. President of ISO is Howard Coonley, chairman of the executive committee of the American Standards Association.

Report on Panama Canal and Its Ports Available

FOR INDIVIDUALS AND agencies interested in the development of harbors and the establishment of port and terminal facilities, the Board of Engineers for Rivers and Harbors has issued a revised report on "The Panama Canal and Its Ports" as No. 40 in its projected series on the principal ports of the United States.

The revised volume contains information with regard to port and harbor conditions, piers, wharves, drydocks, marine repair plants, floating equipment, and wrecking and salvage facilities. Steamship, railroad and air lines serving the Canal are listed, and other data useful to shipping and transportation interests in connection with the movement of goods through the various ports are given.

Those wishing to obtain the volume should address the Board of Engineers for Rivers and Harbors, War Department, Washington, D.C.

Coast and Geodetic Survey Isogonic Chart Available

THE DISTRIBUTION OF magnetic declination throughout the United States and adjacent regions, as of 1945, is shown in a new edition of "Isogonic Chart for 1945," recently issued by the U.S. Coast and Geodetic Survey.

The present edition is on a new base map, prepared to a scale of 1:5,000,000 instead of the former scale of 1:7,000,000. Other departures from the 1940 and previous editions are the showing of cities, towns, lakes, and important rivers to a greater extent than before, and the inclusion of Bermuda and a part of Newfoundland. The isogonic lines are derived from the observed values by a method that gives more consistent recognition to local irregularity than was obtainable by former methods.

This new edition is printed in five colors on heavy chart paper, 31 × 47 in. in size, and is supplied unfolded. It may be obtained, at a cost of 40 cents, from the Director, U.S. Coast and Geodetic Survey, Washington 25, D.C.

Engineering Research Cited by Russell Sage Foundation

IN A SURVEY of research relating to the enlargement of professional service, a recent bulletin of the Russell Sage Foundation cites current efforts of the engineering societies to improve the economic and professional status of the engineer. Particular reference is made to ASCE achievements in the field of classification and compensation of engineers.

The 39-page bulletin—entitled "The Use of Research by Professional Associations in Determining Program and Policy"—also summarizes the program for improving engineering education of such organizations as the Engineers' Council for Professional Development and the American Society for Engineering Education.

The publication may be obtained from the Russell Sage Foundation, 120 East 22nd Street, New York City. The price is 25 cents.

Report on Traffic Engineering Activities Now Available

TRAFFIC ENGINEERING ACTIVITIES in city and state government are summarized by the Eno Foundation for Highway Traffic Control in a 100-page volume entitled *The Organization of Official Traffic Agencies in Cities and States*. In a nationwide survey of the situation—conducted by Wilbur S. Smith, Assoc. M. ASCE, technical adviser to the Foundation—it was found that 55 percent of the 78 cities of more than 50,000 reporting have traffic engineering bureaus or agencies, indicating recognition of the need for trained technical traffic assistance in the larger cities.

Those wishing to obtain copies of the report should get in touch with the Eno Foundation for Highway Traffic Control, Saugatuck, Conn.

E. S. Webster Retires as Board Chairman of Stone & Webster

RETIREMENT OF Edwin S. Webster as chairman of the board of Stone and Webster, Inc., has been announced by that organization's board of directors. Mr. Webster, a co-founder of the firm, will continue his directorships in the company and its subsidiaries, and will maintain his office in the Stone & Webster Building in Boston. He will be succeeded as chairman of the board by William T. Crawford, who has been connected with the organization since 1908—for the past ten years as executive vice-president.

Stone & Webster, Inc.—established by Mr. Webster and the late Charles A. Stone in 1899—was one of the first organizations in this country to operate exclusively as a firm of engineering consultants.

Official Standards for Light-Gage Steel Issued

OFFICIAL INDUSTRIAL STANDARDS for light-gage steel, which will make possible broader uses of the material in certain types of building construction, have been issued by the American Iron and Steel Institute under the title, "Specification for the Design of Light-Gage Steel Structural Members."

This comprehensive 39-page bulletin is the result of a program—initiated in 1939 under the Building Code Committee of the Institute—to study the behavior of light-steel structural members under load and the proper proportioning of such members. The research work was done at the Cornell University college of engineering, under the direction of Dean S. C. Hollister, Prof. W. L. Malcolm, and Dr. George Winter, Members ASCE.

Single copies of the bulletin may be obtained without cost from the American Iron and Steel Institute, 350 Fifth Ave., New York 1, N.Y.

Report on Use of Steel in California Is Issued

PREWAR DEVELOPMENTS, wartime adjustments, and the long-range outlook for the steel and steel-using industries of California are covered in a 400-page report, prepared for the State Reconstruction and Reemployment Commission by the Bureau of Business and Economic Research of the University of California. This steel study was initiated by the Commission as part of its plan for retaining and expanding California's tremendous wartime gains in manufacturing.

The report was prepared under the direction of E. T. Grether, dean of the school of business administration of the university. A limited number of copies are available for distribution from the Printing Division, Documents Section, Eleventh and O Streets, Sacramento, Calif. The price is $1.50, plus a tax of 4 cents.

Drawings and Drafting Room Standards Revised

IN RESPONSE TO widespread requests from engineers and others who found the first edition of "Drawings and Drafting Room Practice" helpful in standardizing drafting room procedures, the American Standards Association has issued a revised edition of this manual—the first since 1935. Sponsor organizations are the American Society for Engineering Education and the American Society of Mechanical Engineers.

Authorized in 1940, the present revision covers the enormous expansion in the use of graphics resulting from war industry, and the development of techniques that have come into common use. Other items covered in this 53-page standardization of American practice include the arrangement of views, line work, dimensioning, sheet sizes, and lettering.

The manual may be purchased from the American Society of Mechanical Engineers, 29 West 39th Street, New York 18, N.Y. The price is $1.50.

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NEW IN Education

Cooper Union Coordinates Courses with Industry

COOPER UNION HAS formulated a plan for further coordinating its evening courses in engineering with the daytime industrial employment of its students. It is proposing various means to facilitate enrollment of selected employees of industrial organizations in free-tuition degree courses.

The Cooper Union School of Engineering, during its 87 years of educating engineers, has become increasingly convinced that industry and the college must supplement one another to provide more competent professional workers, according to Gano Dunn (M. ASCE), president.

Details of the Cooper Union Cooperative Program are outlined in a folder distributed by the school, available on request to the Cooper Union School of Engineering, Cooper Square, New York 3, N.Y.

Iowa U. to Stress Social Science and Humanities

NEW ENTRANCE REQUIREMENTS at the University of Iowa will permit expansion in social science and the humanities during the four-year engineering course. Freshmen entering the College of Engineering after June 1 will be required to present two semester hours of credit (or its equivalent) in college algebra, two in trigonometry, four in English composition and speech, and four in inorganic chemistry. This means that most entering students will require at least one semester of work in a liberal arts or junior college after graduation from high school.

These new requirements are aimed to give the University "one of the best engineering courses in the United States," said Dean F. M. Dawson, M. ASCE, of the College of Engineering. The new course will include a total of about 25 hours in the humanities and other non-technical fields, such as English, speech, history of engineering, technical writing, economics, political and social science. Details of the new program may be obtained from the Office of the Registrar or the College of Engineering, in Iowa City.

Missouri School of Mines Celebrates 75th Anniversary

AN ACADEMIC CONVOCATION commemorating the 75th anniversary of the Missouri School of Mines and Metallurgy was held recently in Rolla, Mo. Dr. Frederick A. Middlebush, president of the University of Missouri, presided and Dr. Eugene McAuliffe, chairman of the Board of Trustees, Union Pacific Coal Co., deliverd the principal address, on "The Engineer's Contribution to Society and the World."

Since the formal opening of the school on "Dedication Day," November 23, 1871, it has expanded from one building, two faculty members, and 28 students, to a modern school of technology valued at more than $3,000,000, having more than 100 faculty members and an enrollment of about 2,200. Established and maintained jointly by the State of Missouri and the federal government under the provisions of the Morrill Act of 1862, it has provided technical and scientific education to more than 10,000 students coming from every state and many foriegn countries.

Postgraduate Fellowships Offered in Public Health

FROM FUNDS contributed to its March of Dimes, the National Foundation for Infantile Paralysis has made a grant of $228,400 for fellowships in postgraduate public health training. These are open to engineers and physicians for the school year beginning in the fall of 1947, and applications will be received at any time before May 1.

The fellowships provide an academic year's graduate training of about 9 months in an acceptable school of public health or sanitary engineering, followed by three months of field training, for men and women under 45 years of age, citizens of the United States. Engineering graduates with a bachelor's or higher degree in sanitary, civil or chemical engineering are eligible, as are those with other engineering degrees who have had experience in the public health or sanitary engineering field. The purpose of the fellowships is recruitment of health officers, directors of special services and engineers to help fill hundreds of vacancies in state and local health departments throughout the country. Intended for newcomers to the public health field, the fellowships are not open to employees of state and local health departments, for whom federal grant-in-aid funds are already available.

Applicants may secure further details by addressing the Surgeon General, U.S. Public Health Service, 19th and Constitution Ave., N.W., Washington, 25, D.C., Attention Public Health Training.

Newark College Establishes Student Screening Procedure

IN ADDITION to the elaborate pre-entrance engineering inventory test designed to evaluate the ability of freshman applicants, Newark College of Engineering has included another academic screening procedure designed to determine the eligibility of sophomores for admission to the junior class. Passing marks will no longer insure automatic promotion of second-year students to third-year standing.

The curricula have been divided into Junior and Senior divisions, representing, respectively, the first and the last two years of college studies. Completion of the pre-professional studies of the Junior Division will be recognized by the award of a diploma and the title, associate engineer. Entrance into the Senior Division, where professional courses commence, will depend upon whether the student can meet the requirements of the professional engineering departments.

NEWS OF Engineers

Ervin Greenbaum, recently released from the Army Ordnance Department with the rank of lieutenant colonel, has been elected president and director of the Empire Tractor Corp., New York City. Prior to entering the service in 1940, Mr. Greenbaum was director and chief engineer of the Michigan Public Works Commission and public works engineer for the Michigan State Highway Department.

Samuel D. Porter has been made a member of the Ann Arbor, Mich., consulting firm of Shoecraft, Drury & McNamee. Mr. Porter has been on the staff of the organization since 1929—of recent years in the capacity of principal assistant engineer.

Arthur D. Kidder and **Joseph C. Thoma** have retired as cadastral engineers for the U.S. General Land Office, Washington, D.C., after many years of service. They will continue their professional work as consulting cadastral engineers, specializing in large-scale cadastral surveys, boundary locations, and riparian rights.

Einar T. Larsen is now chief project engineer in charge of the engineering development of the Eagle Mountain ore deposits for Kaiser Engineers, Inc. Mr. Larsen has been with the Kaiser organization since 1941, and was chief engineer during the wartime construction of Richmond Shipyards Three and Four.

F. R. McMillan, since 1927 director of research for the Portland Cement Association, Chicago, has been promoted to the position of assistant to the vice-president for research and development. Other recent promotions include that of **H. F. Gonnerman,** for the past 19 years manager of the Association's research laboratory in Chicago, to the position of director of research.

Charles T. G. Looney, until lately a civil engineer in the Johns Hopkins University Applied Physics Laboratory at Silver Spring, Md., has become an associate professor of civil engineering at Yale University. He will continue to serve the Laboratory in a consulting capacity.

Harry P. Burleigh, recently released from the Army Engineer Corps, with the rank of major, has accepted a position as head of the recently established Pecos River Basin Coordination Office, with headquarters at Carlsbad, N.Mex. Prior to joining the service, Mr. Burleigh was a geologist for the Soil Conservation Service, in Washington, D.C.

Albert F. Raulin is now on the engineering staff of Jenkins, Merchant & Nankivil, of Springfield, Ill. He was recently released from the Navy Civil Engineer Corps, and before that was testing engineer for the Dravo Corp., in Pittsburgh.

Frederick W. Thortenson has accepted a position in the Fish and Wild Life Service Office in Minneapolis, Minn. He was previously in the Minneapolis office of the Portland Cement Association.

Aren't those grades a little TOO FLAT?

NO... because we're putting in TRANSITE* SEWER PIPE

Transite's exceptionally high-flow capacity (n=.010) often permits a choice of two important economies:

(1) Flatter Grades: This means shallower trenches and correspondingly lower excavation costs—an especially important economy when dealing with deep trenches.

(2) Smaller Diameter Pipe: An alternate economy which the designer may take advantage of when deep trenches present no problem.

Savings like these are possible because Transite Sewer has an exceptionally high-flow capacity (n=.010). Composed of an intimate mixture of asbestos and cement built up on a polished steel mandrel, Transite Sewer Pipe has a smooth interior surface that offers minimum resistance to the flow of sewage.

Other money-saving Transite advantages are:

Less Infiltration—because of sleeve-type joints that *stay* tight...and long 13-foot lengths that result in fewer joints. Thus, the load on the treatment plant is reduced—treatment costs are lowered.

More Economical Installation—because Transite's light weight and long lengths make it easier to lay this pipe to line and grade.

Lower Maintenance Costs—because of Transite's asbestos-cement composition that combats corrosion inside, outside, and all the way through—*plus* tight joints that prevent costly root trouble.

For all the facts, write for the Transite Sewer Pipe brochure. Address Johns-Manville, Box 290, New York 16, New York.

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Karl Terzaghi and **Howard M. Turner** will fill two new professorships, recently established in the Harvard Graduate School of Engineering to give recognition to practicing engineers. They will have the title of Professor of the Practice of Civil Engineering. Dr. Terzaghi has been a visiting lecturer at Harvard since 1936, and Mr. Turner is a Boston consultant.

Samuel H. McCrory, of Washington, D.C., has retired from the Department of Agriculture after 40 years of service. During the war Mr. McCrory headed the nation-wide hemp program of the Commodity Credit Corp., which produced and processed more than 200 million pounds of hemp for military and essential civilian use. He was the first recipient of the John Deere Gold Medal of the American Society of Agricultural Engineers for the "high value to agriculture and to society" of his research and research administration.

Paul E. Gisiger has resigned as structural engineer for the Pennsylvania Water & Power Co. and the Safe Harbor Water Power Corp., Baltimore, to join the engineering staff of the Motor-Columbus Corp., a public utility holding company, with headquarters in Baden, Switzerland. Mr. Gisiger has left for Switzerland, where he will be engaged on a program of hydroelectric power plant construction for the organization.

Joseph M. Werblow, recently relieved from active duty as a lieutenant commander in the Navy, has accepted a position with the Rheinstein Construction Co., of New York City.

A. M. Brenneke, previously with the Institute Nacional de Obras Sanitarias at Caracas, Venezuela, has returned to the United States and is now connected with the Dallas, Tex., engineering firm of Chappell, Stokes and Brenneke.

O. W. Irwin, who recently retired as manager of sales of the Concrete Bar Division of the Carnegie-Illinois Steel Corp., Pittsburgh, has been elected president of the Rail Steel Bar Association, with headquarters in Chicago. A pioneer in reinforced concrete research, Mr. Irwin helped to organize the Concrete Reinforcing Steel Institute, which he served as president for two years and as director for eighteen years. In his new capacity, he will supervise and expand the research and technical activities of the Association.

L. L. Landauer is now connected with the Dallas, Tex., engineering firm of Landauer & Grierrers. Until lately Mr. Landauer was a commander in the Navy, stationed in Washington, D.C.

Joseph E. Jenkins, formerly assistant sanitary engineer in the Houston, Tex., area of the Texas State Health Department, is now district sanitary engineer, with headquarters at Fort Worth. Prior to his connection with the State Health Department, Mr. Jenkins served overseas in the Naval Construction Battalions.

Howard M. Smitten has retired as bridge engineer in the San Francisco office of the Western Pacific Railroad. Mr. Smitten has been in railroad engineering work for 40 years—for the past 25 years as bridge engineer for the Western Pacific.

Thomas R. C. Wilson has retired as chief of the Division of Timber Mechanics, Forest Products Laboratory, Madison, Wis., after 36 years of service with the organization. He has been with the Forest Products Laboratory since the inception of the organization in 1910. After a vacation trip, Mr. Wilson will return to Madison to conduct a consulting service in engineering aspects of wood use, including the design of timber structures (with special attention to glued laminated construction), inspection of timber supplies and structures, and reduction of loss and waste in manufacture.

T. R. C. Wilson

Edward E. Lipinski, formerly project engineer for James Stewart & Co., of Chicago, is now vice-president of J. H. Williams & Co., engineers and contractors of Baltimore.

Chester S. Allen, president of Lockwood Greene Engineers, Inc., of New York, has been appointed to direct the 1947 fund-raising drive for the National Foundation for Infantile Paralysis in the Greater New York area.

John F. Long has accepted a position with the Bureau of Reclamation at Denver, where he will be in the materials laboratory section of the Engineering and Geological Control and Research Division. Mr. Long recently returned from overseas service in a photomapping unit of the Army.

Robert L. Sanks, formerly research engineer in the civil engineering department at the University of California, has taken a post as instructor in civil engineering at the University of Utah.

Lucius D. Clay, lieutenant general, Army General Staff, has been appointed European Theater commander, with headquarters in Berlin. Since the end of the European war, General Clay has been Deputy Military Governor of Germany.

Daniel Noce, major general, General Staff, has been appointed chief of the Civil Affairs Division, Office of the Chief of Staff. General Noce's most recent assignment has been as deputy director of the Service, Supply and Procurement Division General, Staff. He was recently honored by election to the presidency of the newly established Amphibian Engineer Association, which was created in the interest of national defense and to foster the science of amphibian operations.

Robert Lee Morrison, formerly district manager and director of operations for the Federal Works Agency at Knoxville, Tenn., has been appointed city manager of Knoxville.

George S. Robinson, commander, Navy Civil Engineer Corps, has been appointed Naval officer in charge of construction at Camp Lejeune, N.C.

Kenneth C. Roberts has resigned as chief of the Structural and Heavy Equipment Design Division of the Tennesse Valley Authority to accept a position with the Vern J. Alden Engineering Co., of Chicago. He will be succeeded in his TVA position by **George Palo,** who has been serving in the Navy Civil Engineer Corps.

Harry S. Rogers, president of Brooklyn Polytechnic Institute, has been awarded the gold medal of the Downtown Brooklyn Association, which is given annually to the citizen who has rendered "the most distinguished service for Brooklyn." Dr. Rogers, who has been president of the Institute since 1933, received the medal and a scroll at the annual luncheon meeting of the association on January 27. During the war he served as chief of the general products and priorities division, Office of Production Management, and as chairman of the rubber and rubber products branch of the War Production Board.

Warren W. Sadler is now engaged in hydraulic and sanitary engineering with the Chicago consulting firm of Greeley & Hansen. He was formerly junior hydraulic engineer for the TVA.

D. C. Andrews has been appointed general superintendent of construction of the Turner Construction Co. Mr. Andrews has been with the organization in various capacities since 1925. In 1943 he was chosen to fill a position in the organization assembled by the company to help in the production of T-2 tankers at Mobile, Ala., where he was assistant production manager of the shipyard.

Ingwald Edward Flaa, hydraulic engineer for the San Francisco Water Department, has retired from the city's service after 37 years of work on the water supply of San Francisco.

Lawrence A. Elsener and **Harold Gotaas** have been initiated into Chi Epsilon, national civil engineering honor society. Mr. Elsener is district manager of the Chicago Bridge and Iron Co., in San Francisco, and Professor Gotaas is on the civil engineering staff of the University of California.

Harold C. Enderlin, who was recently released from the Navy Civil Engineer Corps, has established a headquarters for the U.S. Soil Conservation Service at Sacramento.

Leif J. Sverdrup, member of the St. Louis firm of Sverdrup and Parcel, has gone to Saudi Arabia, where he will confer with King Ibn Saud on $50,000,000 of construction contracts planned as the start of a modernization program for the country. Mecca and other ancient cities along the Red Sea will be provided with electric and water supply systems under the program. Another ASCE member—**Stephen D. Bechtel,** president of the San Francisco consulting firm, W. A. Bechtel Co.—is also making the trip to Arabia, as his firm is cooperating with the firm of Sverdrup and Parcel in carring out the program.

Paul C. Gillette, commander, Navy Civil Engineer Corps, has been appointed liaison officer for the Civil Engineer Corps Volunteer Reserve Organization within the Potomac River Naval Command. Commander Gillette served overseas during the war, and supervised several of the Seabees major construction projects.

David E. Donley has resigned as hydraulic engineer for the Norfolk District of the U.S. Engineer Department to accept a position as associate professor of hydraulic engineering at Cornell University.

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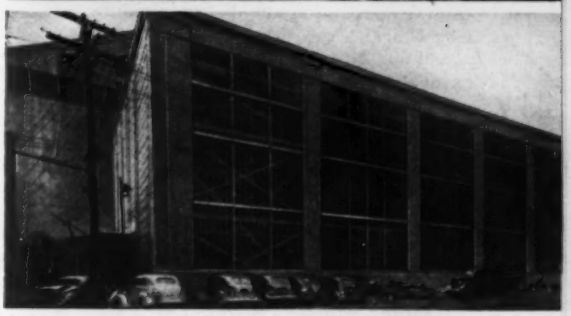
Modern ideas—yes! But with loads of *old-fashioned* customer service and cooperation from the first stages of the job through every phase of construction—right up to completion. Through more than *fifty years* this close customer relationship has built for the FORT PITT BRIDGE organization an enviable record of outstanding SERVICE and ACHIEVEMENT. This broad knowledge and experience is neither confined to a single endeavor nor to the fabrication and erection of steel for any one purpose, but is broad and flexible, adaptable wherever steel is used for permanence and safety.

"Steel Permits Streamlining Construction With Safety, Endurance and Economy"

All over America will be found excellent examples of Fort Pitt Bridge *bridge-building* skill with such types as deck, arch, cantilever, suspension, truss, plate girder and movable construction—many of which are important landmarks in the progress and growth of this industrial nation.

The Pennsylvania Turnpike has set the pattern for many of the new high-speed highways under construction and in the planning stage. Fort Pitt Bridge constructed many of its beautiful bridges—also furnished many tons of reinforcing steel as well as steel for tunnel linings.

Modern factory buildings are designed to be a structure of beauty, as well as functional—they must add value to the area and to the community. Fort Pitt Bridge has kept abreast with these new trends, closely cooperating with industrial architects and engineers. Wherever structural steel is used, Fort Pitt Bridge engineers have the *modern* ideas.



Pridefully, Fort Pitt Bridge shares honors with America's leading architects, contractors and public officials who have designated this organization as the supplier of fabricated structural steel for many of the important federal buildings, post offices, schools, hospitals, memorials and other institutions built during the past fifty years.

In many instances Fort Pitt Bridge has been entrusted with the dual responsibility of fabricating and erecting the structural steel framework for these projects.

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Detroit, Michigan . . . . . New Center Bldg.
Philadelphia, Pa. . . . . Commercial Trust Bldg.

Joseph A. Wahler, construction engineer for the Firestone Plantation Co., has gone to Liberia, Africa, for the company, as general supervisor of construction work on roads and bridges. He was previously with Pan-American Airways.

DECEASED

Walter Wilson Crosby (M. '07) retired civil engineer of Coronado, Calif., died at his home there on December 20, at the age of 74. From 1905 to 1917 Colonel Crosby was chief engineer for the Maryland Geological Survey, and for part of this period held a similar position with the State Roads Commission of Maryland. He then (1917 to 1919) served overseas with the 104th Engineers, attaining the rank of lieutenant colonel. Later he was with the National Park Service and the Pennsylvania State Highway Department. Beginning in 1928, Mr. Crosby maintained a consulting practice in Coronado, and for some years was chairman of the Coronado City Planning Commission.

James Dougan (Assoc. M. '04) retired engineer of Hackensack, N.J., died at his home there on December 16. Mr. Dougan, who was 72, was for many years connected with the New York architectural firm of Clinton & Russell—for 20 years as chief engineer. In the latter capacity, he was in charge of the design of foundations and of construction of heating, ventilation, and plumbing details of the many notable structures erected by the firm in New York and elsewhere. At one time Mr. Dougan was special engineer for the Treasury Department on the heating and ventilation of the Department of Interior Building in Washington.

Alfred Cookman Gregory (M. '13) engineer of sewers and water, Trenton, N.J., died suddenly on November 30. He was 74. Mr. Gregory had been in the Trenton Department of Public Works since 1903. He was chief engineer of the department from 1935 to 1938, and since the latter year had been engineer of sewers and water.

Philip Jewett Hale (Assoc. M. '15) structural engineer for the Freyn Engineering Co., Chicago, died on November 27, at the age of 60. From 1910 to 1916 Mr. Hale was engaged in structural design in the Chicago office of Purdy & Henderson, and from 1917 to 1931 was resident engineer for the Freyn Engineering Co. on the construction of blast furnaces, hydroelectric plants, and other structures. Later Mr. Hale served as associate structural engineer for the Public Works Branch of the Treasury Department in Washington and in 1942 he resumed his connection with the Freyn Engineering Co.

George Samuel Hayes (M. '03) of Whittier, Calif., died in Dewittville, N.Y., recently, at the age of 80. Early in his career Mr. Hayes was with the Kellogg Iron Works, of Buffalo, N.Y.; the Berlin Iron Bridge Co., of East Berlin, Conn.; and the Tostevin-Hayes Fireproof Construction Co., of New York. Beginning in 1899, Mr. Hayes was for many years in private practice in New York as a consulting engineer and contractor.

Charles Adams Hunt (M. '18) retired engineer of Babylon, N.Y., died in July 1946, according to word just received at Society Headquarters. He was 71. Mr. Hunt was for many years in the engineering department of the New York Rapid Transit Railroad Commission and its successor, the New York Public Service Commission, on the construction of subways and elevated railroads in New York and Brooklyn. Later he transferred to the New York Board of Transportation, and he retired in 1934.

Frank David Hutchinson (M. '18) engineer for the Metropolitan Device Corp., Brooklyn, N.Y., died on December 18, at the age of 66. From 1918 to 1940, Mr. Hutchinson was structural engineer for the New York firm of Post & McCord, Inc., in charge of the production of shop details for steel fabrication and the design of erection equipment. Since 1940 Mr. Hutchinson had been engaged in the design of structural steel for the power plant division of the Metropolitan Device Corp.

Paul Wright Longsdorf (Assoc. M. '27) president of Paul W. Longsdorf, Inc., of Elkins Park, Pa., died recently. Mr. Longsdorf, who was 63, had been in private practice in Elkins Park since 1923—first as a member of the firm of Longsdorf & Patterson, and later as president of Paul W. Longsdorf, Inc. Earlier he was supervising engineer for several landscape architects in and about Philadelphia, and from 1915 to 1923 was engineer for Cheltenham Township, Pa., in charge of road and bridge building.

Glenn Russell Loucks (Assoc. M. '31) right-of-way agent for the U.S. Bureau of Reclamation at Sacramento, Calif., died on December 4. He was 59. A specialist in irrigation and valuation, Mr. Loucks had been with the Madera Irrigation District, Madera, Calif.; the San Joaquin River Water Storage District, San Joaquin, Calif.; and the Roosevelt Water Conservation District, Mesa, Ariz. More recently he had been land bank appraiser for the Farm Credit Administration and supervising engineer for the Defence Plant Corp. During the first World War Mr. Loucks served overseas with the 319th Engineers.

Horace Greeley Nave (Assoc. M. '35) of Elizabethton, Tenn., died recently at the age of 44. An alumnus of Virginia Polytechnic Institute, class of 1928, Mr. Nave had been wth the Phoenix Utility Co. and the Knoxville Power Co., and for several years was assistant superintendent and project supervisor of road work in Carter County, Tennessee. From 1935 to 1940 he was with the Tennessee Valley Authority at Knoxville, and from 1940 until recently served as a captain in the Army Corps of Engineers—for part of this period in the Pacific Theater of War.

Frederick Charles Noble (M. '10) retired New York consultant and ASCE Director in 1917 and 1918, died in Gulfport, Fla., on December 17. Mr. Noble, who was 74, was the son of Alfred Noble, Past-President of the Society, in whose honor the Alfred Noble Prize was established. An alumnus of the University of Michigan, Mr. Noble came to New York in 1900 as designer on the Manhattan Bridge, and from 1903 to 1914 was engaged on the construction of the first subway system and as division engineer in charge of construction of the East River Tunnel. From 1914 until his retirement in 1930, Mr. Noble had a general consulting practice in New York. Of recent years he had made his summer home at Fairfield Beach, Conn., and lived at Hollywood, Fla., in the winter.

Lemuel Bynum Ogilvie (Assoc. M. '42) engineer for the Williams Brothers Corp., in Venezuela, died recently in Maracaibo, Venezuela. He was 45. Mr. Ogilvie spent a number of years in Houston, Tex., where he was, successively, with the Texas Co., the Humble Oil & Refining Co., and the American Petroleum Co. From 1926 to 1936 he was with the Harris County (Texas) Engineering Department. In 1938 Mr. Ogilvie went to Venezuela as chief engineer for the Mene Grande Oil Co., and more recently he had been with the Williams Brothers Corp., in Tulsa, Okla., and in the Canal Zone and Venezuela.

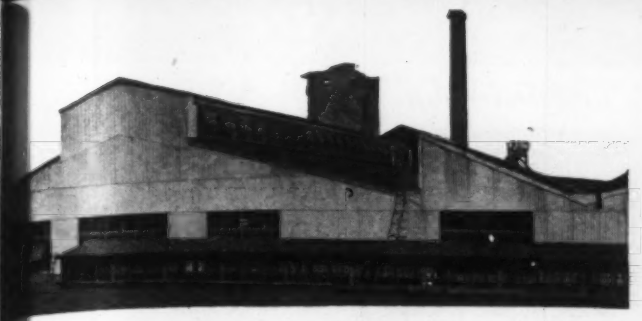
Russell Elstner Snowden (M. '22) of Currituck, N.C., died on December 5, at the age of 65. Mr. Snowden had been construction engineer for the Atlantic Coast Line Railway, and for a number of years was with the North Carolina State Highway Commission. More recently he had a consulting practice at Snowden, N.C.

David Cowan Tennant (M. '28) who retired a year ago as chief engineer for the Ontario Division of the Dominion Bridge Co., died in Toronto, Canada, on November 24. Mr. Tennant, who was 66, spent his entire career with the Dominion Bridge Co., having become connected with the organization in 1900. As structural engineer at Montreal for much of this period, Mr. Tennant designed and supervised the construction of the steelwork for the parliament buildings at Ottawa, the Canadian Pacific Railway bridge over the St. Lawrence, and other notable structures. From 1933 until his retirement in 1945, Mr. Tennant was in Toronto.

Herman Van der Veen (M. '20) hydraulic engineer of Beek, Nijmegen, Netherlands, died on October 27, at the age of 68. Although born and educated in Holland, Mr. Van der Veen spent much of his career in the Orient. He was engaged on river and harbor improvements in Java and Sumatra, and from 1914 to 1930 was consulting engineer and hydraulic engineering adviser to the Chinese Government Conservancy Bureau. Returning to the Netherlands, Mr. Van der Veen then became government engineer for the Bureau Rijks Water Staat.

Louis Joseph Voorhies (M. '39) consulting engineer of Baton Rouge, La., died on August 25, 1946, according to word just received at Society Headquarters. His age was 60. Mr. Voorhies spent his early career in railroad engineering work, and later (1913 to 1915) was city engineer of Lafayette, La. From 1917 to 1918 he was associate professor of highway engineering at Texas A. & M. College, and from 1918 to 1926 district manager for the J. B. McCrary Engineering Corp., of Atlanta, Ga. Since the latter year he had had a consulting practice in Baton Rouge.

Benjamin Weiss (Assoc. M. '28) an engineer in the Queens Borough President's office, died suddenly on December 30, in Emporia, Va., where he was vacationing.

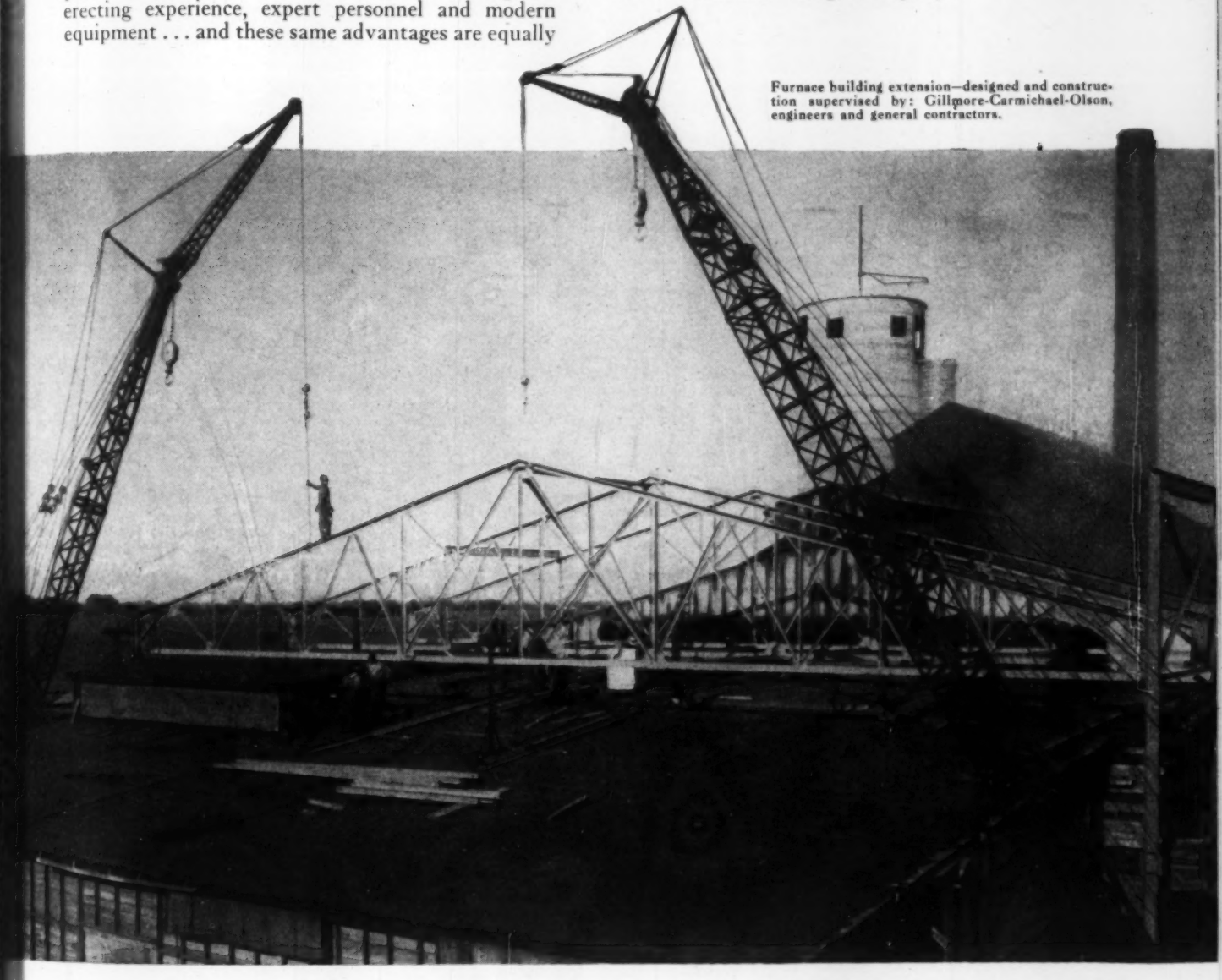


New building erected over old

—without interrupting production!

AMERICAN Bridge Company erected this modern steel addition to an Illinois plant. Work continued uninterrupted in the original wooden buildings while the new structure was built right over them.

This unusual money-saving procedure was made possible by American Bridge's wide fabricating and erecting experience, expert personnel and modern equipment . . . and these same advantages are equally available to you. Why not get in touch with our nearest contracting manager? He can help you with your building planning, to make sure that your building will be ready when needed. And behind him—whether your project is large or small—stand the entire facilities of American Bridge Company.



Furnace building extension—designed and construction supervised by: Gillmore-Carmichael-Olson, engineers and general contractors.

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UNITED STATES STEEL

Mr. Weiss, who was 60, was in the engineering employ of the City of New York for 39 years. He had served as chief of the Queens Topographical Bureau and as representative of the Borough President's office on the Board of Estimate. His most recent assignment was as postwar coordinator for Queens projects. A member of the executive board of the Municipal Engineers of the City of New York, Mr. Weiss had been editor of the *Municipal Engineers Journal*.

Dalton Russell Wells (M. '14) Detroit engineer, died on March 8, 1946, according to word just received at Society Headquarters. He was 67. Early in his career Mr. Wells was structural engineer for the Detroit firm of Smith, Hinchman & Grylls and engineer in charge of the Detroit Department of Buildings. Later (1923 to 1926) he was building superintendent for Schenck & Williams, architects of Dayton, Ohio, and from 1926 to 1930 he was engineer in charge of construction for the Dayton firm of Charles H. Shook, Inc. For some years Mr. Wells headed his own engineering and architectural practice in Detroit.

Applications for Admission or Transfer

February 1, 1947 **Number 2**

The Constitution provides that the Board of Direction shall elect or reject all applicants for admission or for transfer. In order to determine justly the eligibility of each candidate, the Board must depend largely upon the membership for information.

Every Member is urged, therefore, to scan carefully the list of candidates published each month in CIVIL ENGINEERING *and to furnish the Board with data which may aid it in determining the eligibility of any applicant.*

It is especially urged that a definite recommendation as to the proper grading be given in each case, inasmuch as the grading must be based upon the opinions of those who know the applicant personally as well as upon the nature and extent of his professional experience. Any facts derogatory to the personal character or professional reputation of an applicant should be promptly communicated to the Board. Communications relating to applicants are considered strictly confidential.

The Board of Direction will not consider the applications herein contained from residents of North America until the expiration of 30 days, and from non-residents of North America until the expiration of 90 days from the date of this list.

MINIMUM REQUIREMENTS FOR ADMISSION

GRADE	GENERAL REQUIREMENT	AGE	LENGTH OF ACTIVE PRACTICE	RESPONSIBLE CHARGE OF WORK
Member	Qualified to design as well as to direct important work	35 years	12 years	5 years
Associate Member	Qualified to direct work	27 years	8 years	1 year
Junior	Qualified for subprofessional work	20 years	4 years	
Affiliate	Qualified by scientific acquirements or practical experience to cooperate with engineers	35 years	12 years	5 years

APPLYING FOR MEMBER

ANDERSON, CHARLES GRIFFIN (Age 45) Regional Engr., Bureau of Reclamation Region 6, Billings, Mont.

BEAVIN, BENJAMIN EVERETT (Assoc. M.) (Age 45) Project Engr. and Assoc. J. E. Griener Co., Cons. Engrs., Baltimore, Md.

BECHERT, CHARLES HAROLD (Age 41) Director, Div. of Water Resources, Dept. of Conservation, Indianapolis, Ind.

BOARDMAN, EDGAR THURSTON (Age 45) Bridge Engr., Missouri Dept. of Highways, Carson City, Nev.

FARRINGTON, ARTHUR E. (Assoc. M.) (Age 57) Asst. Dist. Engr., Pennsylvania Highway Dept., Williamsport, Pa.

FOSTER, EDGAR EUGENE (Assoc. M.) (Age 52) Engr. (Hydr.) Hydrology Div., Branch of Project Planning, U.S. Bureau of Reclamation, Denver 2, Colo.

HAHN, ROBERT LE ROY (Assoc. M.) (Age 35) Chief Structural Engr., Jones-Hettelsater Construction Co., Kansas City, Mo.

HARROLD, LLOYD LARREN (Assoc. M.) (Age 39) Project Supervisor (P-5) Soil Conservation Service, Coshocton, Ohio.

HART, SCOTT PARK (Age 57) Materials Engr., Montana Highway Comm., Helena, Mont.

HENRY, THOMAS BROWN (Age 49) Member of firm, Jones & Henry, Cons. Engrs., Toledo, Ohio.

HUCKINS, EDGAR WOLCOTT (Age 55) Senior Engr., Industrial Eng. Sec., RFC, Washington, D.C.

HUPCZYC, BOLESLAW (Age 42) Warsaw, Poland. (Temporary address, Washington, D.C.)

KEITH, WARREN GRAY (Age 38) Asst. Prof., Univ. of Alabama, University, Ala.

KELKER, JAMES JOSEPH ARTHUR (Assoc. M.) (Age 40) Div. Engr., The Ohio Oil Co., Shreveport, La.

KHANNA, GIAN CHANDRA (Age 38) Selected for training in United Kingdom and U.S.A. by Govt. of India.

LAMOREAUX, RAYMOND (Jun.) (Age 35) Comdr. (CEC) USN, Head Aviation Div., Bureau of Yards & Docks, Washington, D.C.

LARSON, LINNE CLARENCE (Assoc. M.) (Age 47) Engr., Taylor & Taylor, Cons. Engrs., Los Angeles, Calif.

MAUGH, LAWRENCE CARNAHAN (Assoc. M.) (Age 45) Associate Prof. of Civ. Eng., Univ. of Michigan, Ann Arbor, Mich.

MAYNARD, GORDON SCOTT (Age 46) Dist. Engr., Portland Cement Association, Richmond, Va.

MICHAELIDES, MICHAEL (Age 48) Director 1st class, Ministry of Agriculture, Athens, Greece; Bureau of Reclamation, Denver, Colo.

MITCHELL, RICHARD RAY (Assoc. M.) (Age 64) Senior Highway Engr., PRA, Ogden, Utah.

MORSE, REED FRANKLIN (Assoc. M.) (Age 48) Prof. of Civ. Eng., Kansas State Coll., Manhattan Kans.

PETERSON, EDMUND NICOLAI (Age 56) Member, Coordinating Group, Northwest Power Pool, being Cons. Engr., Portland, Ore.

POWELL, CARL WILLIAM (Jun.) (Age 35) Asst. Chief, Maintenance & Repair Sec., Hdq., 4th Army, Fort Sam Houston, Tex.

SCROGGIE, EVERETT (Assoc. M.) (Age 43) Senior Structural Engr., TVA, Knoxville, Tenn.

SHELTON, ARCHER VENABLE (Age 46) Chief, Gen. Eng. Branch, Office Div. Engr., U.S. Army, Atlanta, Ga.

STICKLE, SAMUEL DARK (Assoc. M.) (Age 38) with Great Lakes Dredge & Dock Co., New York City.

VINCENZ, JEAN LACEY (Age 52) Head Constr. Engr., Office of Chf. of Engrs., Washington, D.C.

WAGNER, KARL BURNHAM (Assoc. M.) (Age 36) Gen. Contr., Austin, Tex., also member of firm, Dalton & Wagner, Dallas, Tex.

WEBB, CHARLES MARCUS, JR. (Age 44) Prin. Engr. (civilian), Chief Central Sec., Hospital Branch, Office of Chief of Engrs., Washington, D.C.

WHITE, LLOYD KENNEDY (Age 52) City Engr., Wichita, Kans.

APPLYING FOR ASSOCIATE MEMBER

ACKERMANN, WILLIAM CARL (Jun.) (Age 33) with TVA, Knoxville, Tenn.

BERTRAND, ROBERT LOVE (Age 39) Civ. Engr. (P-3), Veterans Administration, Dallas, Tex.

BRAY, LYMAN SNYDER (Age 36) Senior Engr., Dept. of Roads & Irrigation, Lincoln, Nebr.

BRENNER, NATHAN (Jun.) (Age 34) Senior Engr. (Administrative), Trans. World Airlines, New York City.

BURKS, SAMUEL DAVID (Age 31) Engr., Materials, U.S. Engr. Dept., Sacramento, Calif.

CARBALLEIRA, ROBERT JOSEPH (Age 30) Flushing, N.Y. Recently with CEC, USNR.

CHAPMAN, PHILIP STANARD (Age 45) Asst. Engr., U.S. Engr. Dept., Honolulu, Hawaii.

CLARY, WILLIAM CRAIG (Age 36) Associate Bridge Engr., Virginia Highway Dept., Richmond, Va.

CRAIG, WILLIAM BARNARD (Age 31) Engr. (Hydr.), P-2, U.S. Engr. Dist. Office, Omaha, Nebr.

DARLING, WILFRED DELOS (Age 39) Engr. (P-3), Design Branch, U.S. Engr. Dept., St. Paul, Minn.

DIAMOND, WILLIAM HOWARD (Age 37) Chief Structural Designer, Jessop & Co., Calcutta, India.

DUCLOS, FRANCIS GEORGE (Jun.) (Age 32) Contr., Contoocook, N.H.

DJANG, YUAN HSI (Age 33) Director and Chief, Bureau of Water Conservancy, National Conservancy Comm. of China, Berkeley, Calif.

ELDRIDGE, ALBERT MATTHEWS (Jun.) (Age 31 Design Engr. (Sanitary), City of Austin, Tex.

ERICKSON, LINNE FELIX (Jun.) (Age 34) Testing Engr., Idaho Bureau of Highways, Boise, Idaho.

GESELE, FRANK EDWARD (Age 41) Job Engr., G. H. Flinn Corporation, New York City.

GRAGG, JOHN EDWIN (Age 38) Office Engr., Rollins & Forrest, Dallas, Tex.

GRONER, DAVID (Jun.) (Age 33) Superv. Engr., Reconstruction Finance Corporation, Office of Defense Plants; address, Woodhaven, N.Y.

HIPP, CHARLES LEO (Age 37) Senior Engr., USED, Omaha, Nebr.

KALYANARAMAN, VENKATARAMAIYER (Age 36) Graduate Student, Univ. of Toronto, Canada.

KELLEY, ALEXANDER COWAN (Age 30) Asst. Engr., Nashville, Chattanooga & St. Louis Ry., Nashville, Tenn.

KRAPP, LEO FRIEDMANN (Jun.) (Age 28) Jun. Engr. Weir Kelby Corporation, Norwood, Ohio.

KRISHNA, JAI (Age 34) Asst. Prof. of Civ. Eng. Thomason Coll., Roorkee, India.

LEGGETT, CHARLES DURYEA (Age 37) Project Engr., Parsons, Brinckerhoff, Hogan & MacDonald, Caracas, Venezuela.

MERRIAM, JOHN LAFAYETTE (Jun.) (Age 35) Asst. Civ. Engr. (P-2), SCS, Yucaipa, Calif.

MINNICH, JOHN HARVEY (Age 41) Prof. of Civ. Eng., Thayer School of Civ. Eng., Etna, N.H.

MORRISON, HERBERT JOHN (Jun.) (Age 35) Estimating Engr., Dept. of Water & Sewers, Miami, Fla.

OAKLEY, ROBERT ETHAN (Age 40) Asst. Highway Engr., California Highway Department, Fresno, Calif.

O'BRIEN, JOHN THOMAS (Jun.) (Age 35) Hydr. Engr. (P-3), SCS Laboratory, California Inst. of Technology, Pasadena, Calif.

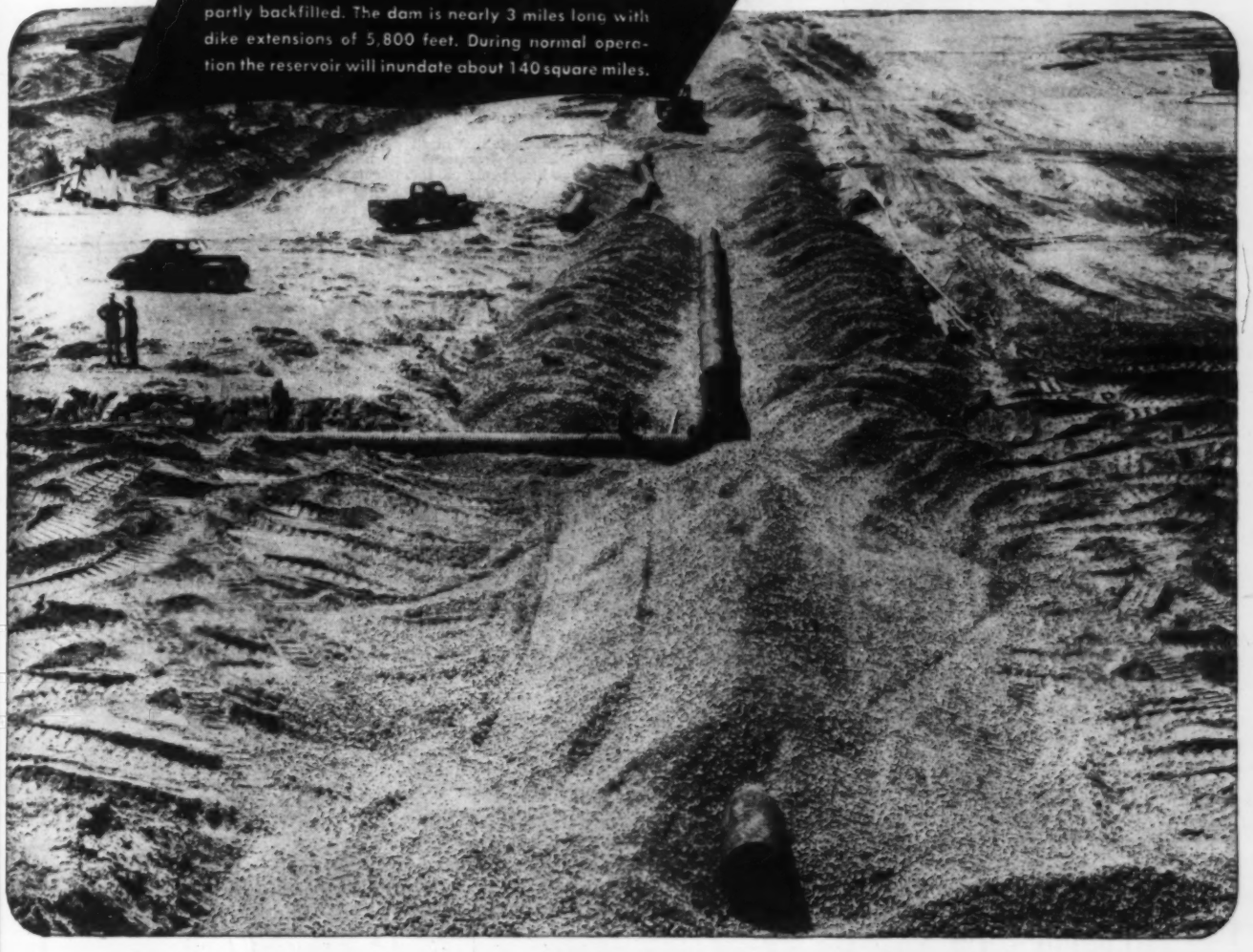
OLIN, SEXTON ARTHUR (Jun.) (Age 31) Engr., Cons. Engrs., C.A., Caracas, Venezuela.

PAGELS, GEORGE, JR. (Jun.) Vice-Pres., The Penetryn System, Inc., Consulting, Designing and Contracting Engrs., Chicago, Ill.

RUSSELL, ALEXANDER DAVID (Age 35) Engr., Donald R. Warren Co., Oakland, Calif.

SAGEHORN, EARNEST HENRY (Age 43) Asst. Bridge Engr., California Dept. of Public Works, Sacramento, Calif.

SCHAMBERGER, KARL HENRY (Age 43) Senior Engr. (Civ.), Bureau of Water Supply, Baltimore, Md.



Toe drain trench with 30-inch ARMCO Perforated Pipe partly backfilled. The dam is nearly 3 miles long with dike extensions of 5,800 feet. During normal operation the reservoir will inundate about 140 square miles.

THIS PIPE GUARDS A DAM AND 2 BILLION GALLONS OF WATER

At each junction of mains and laterals a corrugated metal manhole, reducing from 48 to 24 inches in diameter, provides access for cleanouts and inspections.

Here's how engineers employed an Armco subdrainage system to protect one of the world's largest rolled-fill earthen dams nearly 3 miles long.

The 30-inch ARMCO Perforated Pipe was installed under the dam with 12, 18, 24 and 30-inch laterals and outlets. By intercepting seepage water resulting from hydrostatic pressure, the system effectively prevents uplift or boiling on the downstream side.

Installation was easy, thanks to the light weight and freedom from breakage of ARMCO Pipe. Tight joints, so essential to the safety of the dam, were assured by Armco's method of joining long pipe lengths with sturdy band couplers.

You'll find an Armco subdrainage system indicated wherever harmful ground water must be removed to keep subgrades firm and stable. ARMCO Pipe has proved its ability to resist crushing, cracking or disjointing under the impact and weight of heavy loads. Efficiency remains high because there is less chance of silting or clogging. Write today for complete information. Armco Drainage & Metal Products, Inc., and Associated Companies, 815 Curtis St., Middletown, Ohio.

ARMCO PERFORATED PIPE

SNOW, MARTIN JOSEPH (Jun.) (Age 32) Officer in Charge of Constr., Naval Ordnance Test Station, Inyokern, Calif.

STIENE, ROBERT MARION (Jun.) (Age 34) Engr., Cia. McGraw-Warren, Cochabamba, Bolivia.

STRAUSS, MAX WILLIAM (Jun.) (Age 32) Structural Engr., Dept. of Water & Power, Los Angeles, Calif.

SUTHERLAND, MARVIN MCTYEIRE (Jun.) (Age 34) Asst. Chief Engr., State Div. of Budget, Richmond, Va.

VINCENT, JAMES ALBERT (Age 32) Jun. Highway Engr., St. Clair County Highway Dept., East St. Louis, Ill.

WIGGINS, ALBERT ROBERT (Age 30) Structural Designer, Faisant & Kookeu, Cons. Engrs., Baltimore, Md.

WILLIAMS, SAM S. (Jun.) (Age 35) Major, Corps of Engrs., U.S. (Regular) Army.

APPLYING FOR JUNIOR

CAGLEY, LEO W. (Age 27) Civ. Engr., Office Eng. Div., The Panama Canal, Balboa Heights, Canal Zone.

DE BLAS GOMEZ, ISIDORO (Age 31) Sent to United States by Inst. Tecnico de La Construction y Edification to study and conduct research for construction of plain and reinforced concrete structures.

MALIK, BASHIR AHMED (Age 25) Graduate Student, Univ. of Utah, Salt Lake City, Utah.

MANNES, ARNIE EARL (Age 29) Graduate Student, Univ. of Ill., Champaign, Ill.

RODRIGUEZ-DERRIEN, ARISTEDES (Age 25) Structural Engr., Crocker & Ryan, Denver, Colo.

TOWERY, PAT (Age 25) Structural Engr., The Metallic Building Co., Houston, Tex.

The Board of Direction will consider the applications in this list not less than thirty days after the date of issue.

Engineering Societies Personnel Service, Inc.

NEW YORK	CHICAGO	DETROIT	SAN FRANCISCO
8 W. 40th St.	211 W. Wacker Dr.	100 Farnsworth Ave	57 Post St.

The items listed below have been furnished by the Engineering Societies Personnel Service, Inc., which is under the joint management of the Four Founder Societies. This service is available to members and is operated on a cooperative, non-profit basis. In applying for positions advertised by the Service the applicant agrees, if actually placed in a position through the Service as a result of these advertisements, to pay a placement fee in accordance with the rates as listed by the Service. These rates have been established in order to maintain an efficient non-profit personnel service and are available upon request. This also applies to registrants whose notices are placed in these columns. All replies should be addressed to the key numbers indicated and mailed to the New York Office.

A weekly bulletin of engineering positions open is available to members of the cooperating societies at a subscription of $3 per quarter or $10 per annum, payable in advance.

Men Available

ENGINEER; Jun. ASCE; 22; single; B.C.E. degree; 6 months' experience in structures and testing in aircraft plant; part-time experience with sanitary engineering firm, field and office work; knowledge of high school French and Spanish. Will consider any location in any civil engineering field. Available April-May. C-342.

ASSOCIATE PROFESSOR OF CIVIL ENGINEERING; Assoc. M. ASCE; 40; 15 years' civil engineering teaching. Practical experience in sanitary, highway, and hydraulic engineering. Proved administrator. Available for spring term. C-343.

ENGINEER; Jun. ASCE; age 28; B.S. in C.E.; sanitation management major; 3 years of chemical engineering and additional study in industrial engineering. Desire permanent position. Previous experience in mechanical design; aircraft stress; industrial engineer (wage incentive); production engineer (layout, etc.); research. C-344.

CITY MANAGER; M. ASCE; 51; married; registered civil engineer with 20 years' broad experience in charge of planning and construction of structures (hotels, houses, service headquarters, shelters, etc.), dams, roads, water systems, sewage systems for 40 state recreational and memorial properties; 4 years as post engineer (repairs and utilities) for a large Army camp. Available one month's notice. Location desired, West—California preferably. C-345.

CIVIL ENGINEER; M. ASCE; 40; registered New Jersey and Maryland; airport, waterfront, maintenance, surveys, industrial, and general building construction experience. Engineer in charge of construction on various contracts, averaging one to two million dollars per year during past 6 years. Recently Commander, CEC, U.S.N.R., and public works officer at one of the largest air stations in the East. C-346.

ENGINEER; M. ASCE; college graduate; New York and New Jersey licenses; with 27 years' experience in steel and concrete design of industrial buildings, housing, subway, arches, heavy foundations, and water supply. Want responsible permanent position in New York City or northern New Jersey, preferably with small concern. C-347.

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Draftsman - Derailers

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Experienced in Structural Steel Fabrication of Buildings, Bridges, etc.

Top Pay **Permanent**

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CONSOLIDATED STEEL CORPORATION

Personnel Department

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Positions Available

COST ENGINEER, 35–45, with construction experience, covering estimating labor, materials, and equipment, for field assignment on heavy construction. Locations, Venezuela or Dominican Republic. Salary, $4,800 a year plus subsistence. W-7220(*a*).

CIVIL ENGINEER, graduate, with at least 5 years' design experience in heavy construction, to design and lay out piers, wharves, and bulkheads, etc. Salary, $4,000–$5,000 a year. Location, New York, N.Y. W-8084.

SALES ENGINEERS. (*a*) Sales Engineers (two), 25–30, civil graduates, with highway construction experience, to represent asphalt producer, in calling on road contractors, high officials, etc. Must own car. Location—one for Westchester County and one for northern New Jersey. Salary, $3,600 a year, plus expenses. (*b*) Sales Engineer, under 25, to call on industrial users of asphalt, such as roofing manufacturers, flooring specialists, etc. Headquarters, New York, N.Y. W-8095.

STRUCTURAL ENGINEER thoroughly experienced in design of locks and dams and with experience in mechanical design of hydraulically operated equipment, to handle design on a number of locks and dams for control of tidal waters. Location, Florida. W-8211.

CIVIL ENGINEER, young, with some design experience in simple foundations, structural steel, and reinforced concrete. Will probably do some costs, inspection, supervision, and main office work. Salary open. Location, upstate New York. W-8329.

ASSOCIATE OR FULL PROFESSOR, structural engineer, 30–45, to teach courses in structures, reinforced concrete, and allied subjects. Should be able to show high degree of accomplishment in structural design or research work, or engineering publication. Salary open. Location, upstate New York. W-8372(*a*).

ARCHITECTURAL OR CIVIL ENGINEERING DRAFTSMAN, young, who has had some drafting experience along architectural lines. Should have had experience on terminals, warehouses, restaurants, etc. Excellent opportunity. Salary to start, $2,500–$3,500 a year. Location, New York, N.Y. W-8380.

INSTRUCTOR IN CIVIL ENGINEERING. Salary commensurate with experience and ability. Send full qualifications and photograph in first letter. Location, eastern Pennsylvania. W-8393.

STRUCTURAL DRAFTSMAN, young, graduate preferred, to prepare shop drawings for structural steel, ornamental iron, steel stairs, etc., and to take measurements in the field. Later there will probably be some estimating. Permanent. Location, upstate New York. W-8411.

ENGINEERS. (*a*) Superintendent of construction experienced in heavy construction, particularly superstructures and power plants. (*b*) Field Engineers (two) on heavy construction. One for straight engineering work, and the other to act as assistant superintendent. Salaries open. Locations, Ohio and Colorado. Interviews, New York, N.Y. W-8423.

ENGINEERS. (*a*) Engineers to design and detail water-supply distribution and sewerage systems. (*b*) Estimator for water supply and sewage systems, with recent experience in preparing trenching and excavation estimates. (*c*) Architectural Designers and Draftsmen. Locations, Washington and Alaska. W-8429.

LABORATORY ASSISTANT, preferably civil graduate, with at least 3 years' concrete testing experience, to assist in testing, report writing, etc., covering various cements, sands, gravel, stone, and coral aggregates. Salary, $6,600–$7,200 a year. Location, Guam. W-8439.

PROJECT MANAGER to act as general superintendent for large building construction job. Must have had considerable experience in similar construction work. Salary, $7,800–$8,500 a year. Location, New York, N.Y. W-8448.

DESIGNING ENGINEERS, civil, electrical, and mechanical, in all grades for plans and specifications of large sewage disposal project. Salary, $350–$457 a month, 40-hour week. Opportunity for advancement. San Francisco Bay Area. S-412.

INSTRUCTOR AND RESEARCH ASSOCIATE to teach undergraduate mechanics plus some graduate work. Salaries: Instructor, $2,150–$2,650; Research Associate, $3,800–$4,800 a year, with one month's vacation. Location, Virginia. W-8381.

The Embarrassment of Success

EVERY now and then a manufacturer succeeds in making a product so outstanding that public demand for it overwhelms production facilities. In his zeal for winning friends he finds himself making enemies—people eager to buy who cannot be assured immediate or even early delivery.

Thus, the earnestness the manufacturer has given to years of research and development—of product improvement and still better product performance—of efficient manufacture and unusual customer service . . . seems to come back to haunt him.

It is the embarrassment of success.

In becoming the world's leading manufacturer of Diesel engines, track-type tractors and motor graders, "Caterpillar" found many buyers forming a waiting line during the years when all products went into war use. To that waiting line were added many more whose favor was won by the illustrious war performance of these machines.

Thus, despite the fact that "Caterpillar" production is at a high point, demand is still outrunning supply. To catch up—and also to provide an extra margin of facilities for future needs—production is being increased as rapidly as possible by an expansion program that is adding *50 per cent more plant.*

"Caterpillar" is deeply conscious of the problems of the many users who prefer and patiently wait for "Caterpillar" products. "Caterpillar" thanks every customer for such patience in awaiting his turn on deliveries. You can be sure that "Caterpillar" effort is the human utmost. It is live, resourceful—determined that, even in the face of material shortages and disturbed economic conditions, there shall be no unnecessary delays.

CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS

CATERPILLAR Diesel

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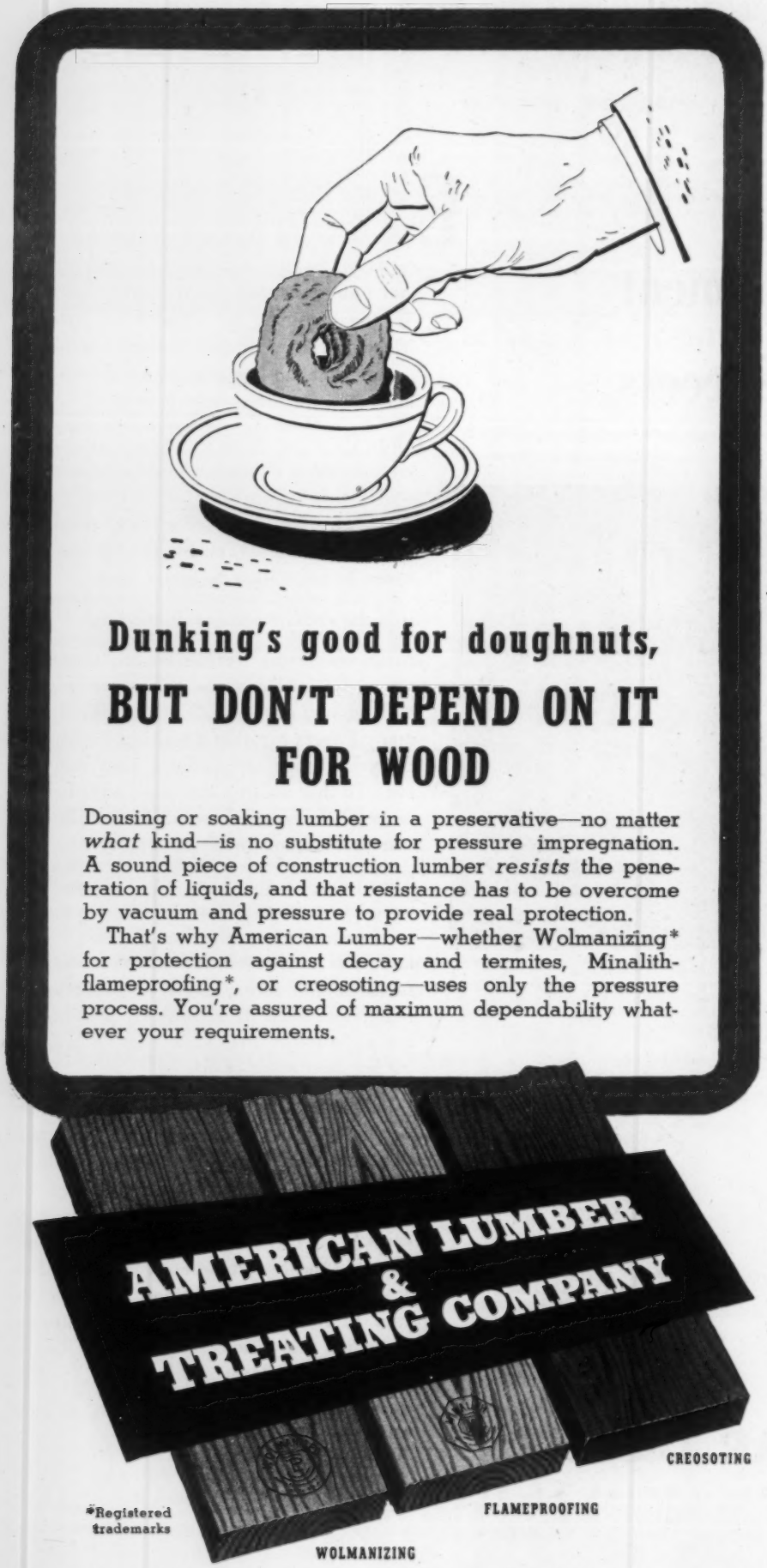
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(*Continued from page 87*)

To compare Eq. 2 with Eq. 1, both will be used in the solution of a problem.

ILLUSTRATION. Given a 16 × 16-in. tied column with eight $^7/_8$-in. round bars. $E_s = 30{,}000{,}000$ psi; $E_c = 3{,}000{,}000$ psi. Assume that $c = 0.000{,}001$ in. per in. Find f_c in terms of f_{co}.

$A_s = 8(0.60) = 4.8$ sq in.

$A_c = 256 - 4.8 = 251.2$ sq in.

$n = 10$

By Eq. 1:

$$f_c = \frac{f_{co}}{\frac{0.000{,}001}{\frac{251.2}{e^{4.8(30{,}000{,}000)}} + \frac{1}{3{,}000{,}000}}} = 0.617 f_{co}$$

By Eq. 2: $f_c =$

$$f_{co}\frac{251.2 + 4.8\left[10 - 30{,}000{,}000\left(\frac{0.000{,}001}{2}\right)\right]}{251.2 + 4.8\left[10 + 30{,}000{,}000\left(\frac{0.000{,}001}{2}\right)\right]} = 0.611 f_{co}$$

A formula identical with that shown as Eq. (8-6) in Sutherland and Reese's *Reinforced Concrete Design* may be obtained by the method employed in deriving the preceding Eq. 2 if Δ_p is made proportional to the final stress in the concrete, that is, if

$$\Delta_p = f_c c \quad . \quad . \quad . \quad . \quad . \quad (h)$$

If the first term in Eq. (*g*) is replaced by the value of Δ_p from Eq. (*h*)—instead of from Eq. (*d*)—the solution of the resulting equation gives

$$f_c = \frac{f_{co}(A_c + E_s A_s/E_c)}{A_c + (E_s/E_s + cE_s)A_s} \quad . \quad (3)$$

which is the same as Eq. (8-6) mentioned above.

Application of Eq. 3 to the problem solved by Eqs. 1 and 2 gives

$$f_c = f_{co}\frac{251.2 + 10(4.8)}{251.2 + (10 + 30)4.8} = 0.674 f_{co}$$

Study of the results obtained by Eqs. 1, 2, and 3 shows that under a decreasing stress the plastic deformation of concrete is proportional, not to the final stress (as in the case of elastic deformations), but very nearly to the arithmetic mean of the initial and final stresses in the concrete during the deformation.

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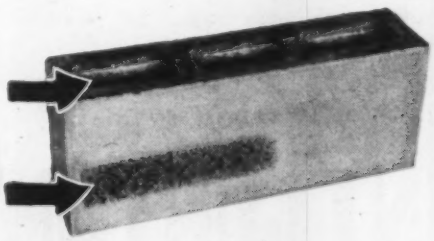
To Illustrate:

1 *Here is an Aquellized concrete masonry unit filled with water. Naturally, there is no leakage.*



2 *But what happens if the Aquella surface coating is scraped off? To answer that, we scraped away this portion, and there's still no leakage. This may be slightly puzzling until you study the photograph of the third step...*

3 *The enlargement of a small, sawed-away section of the above block, which shows the way Aquella penetrates to fill and close the microscopic pores of the surface. It is the filling of the pores—not essentially the surface coating—which stops the penetration of water.*

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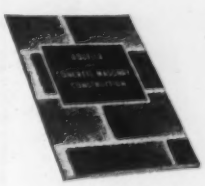
We would like to send you details of this test. It is contained in our booklet, "Aquella and Concrete Masonry Construction." This booklet also contains many illustrations of the uses of Aquella in concrete masonry construction throughout the United States, and should prove very interesting to all in the construction industry. It is yours for the asking.



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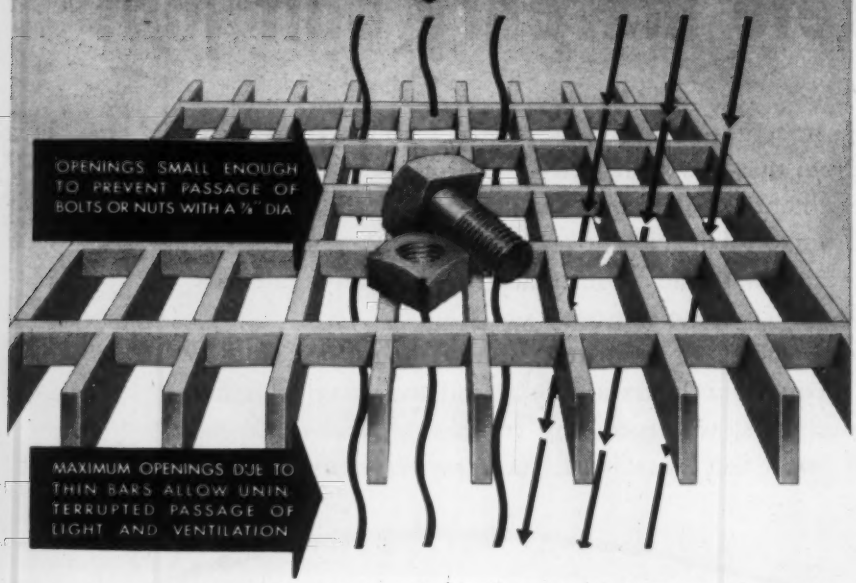
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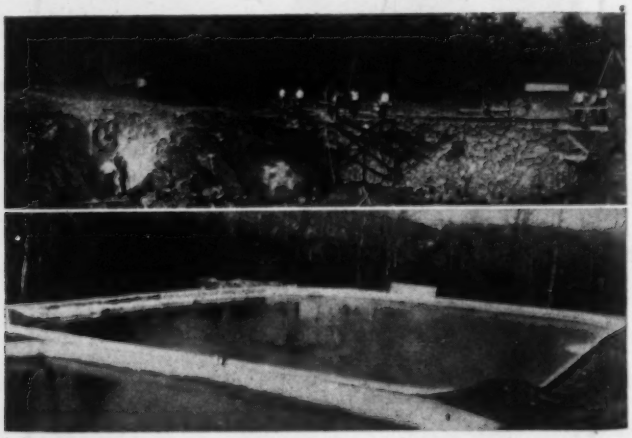

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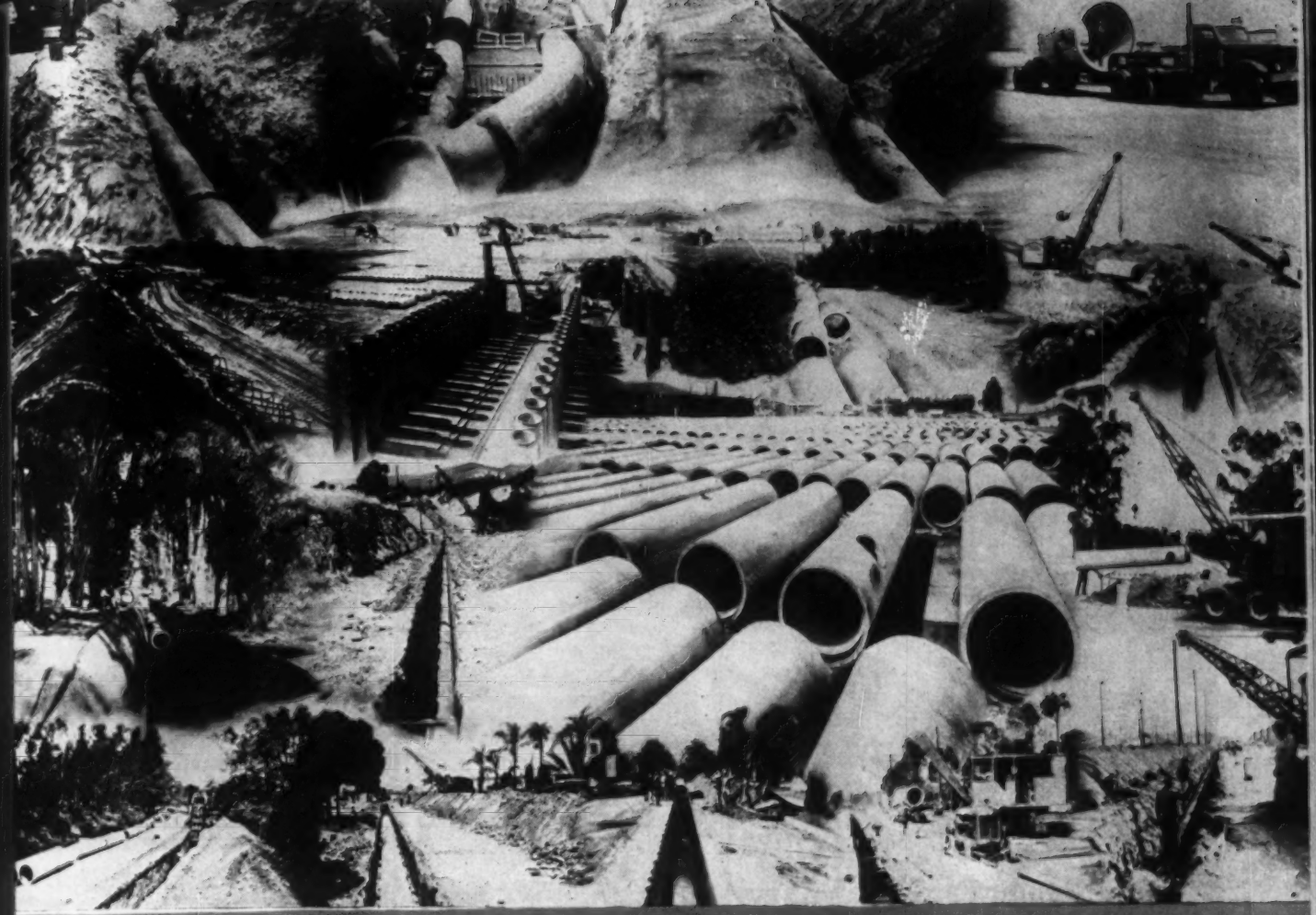

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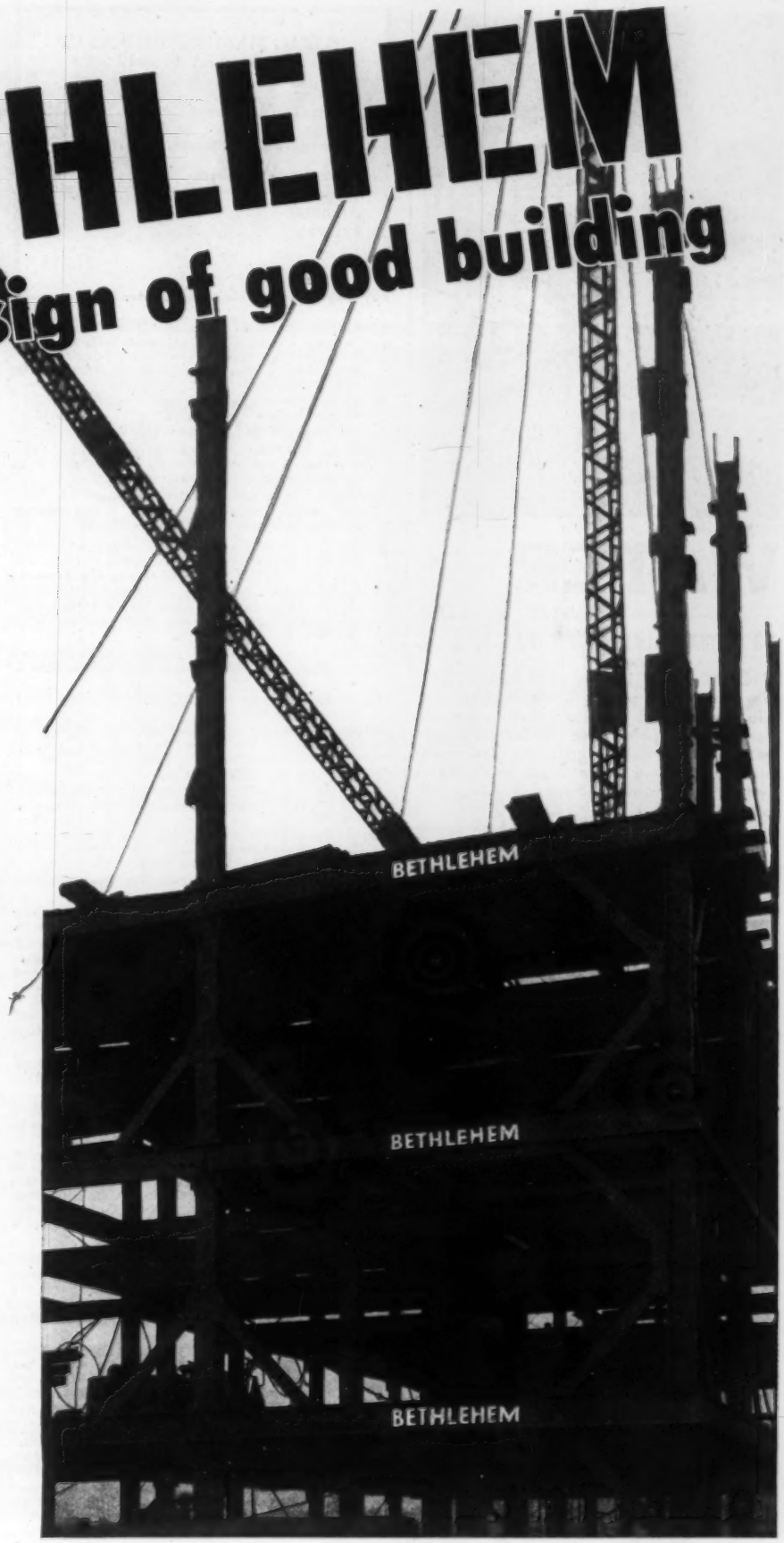

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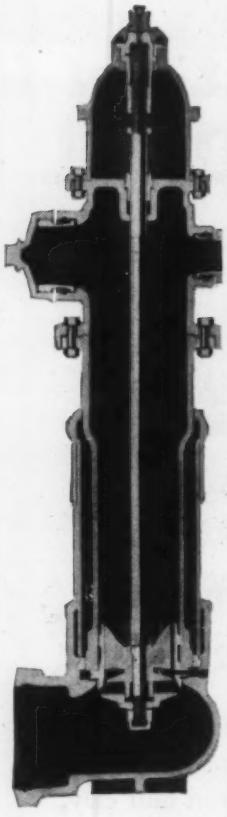

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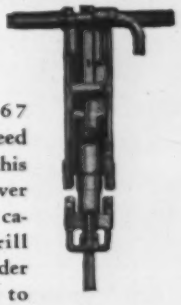

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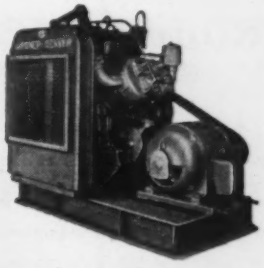

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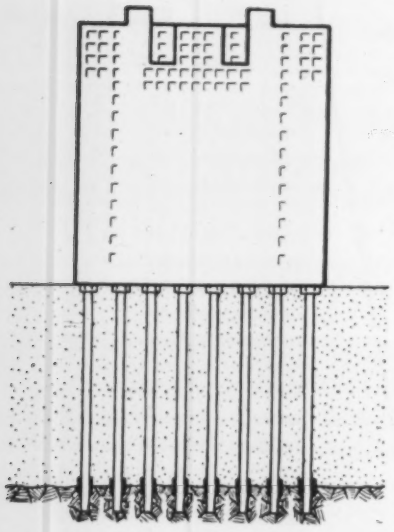

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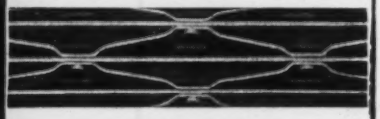

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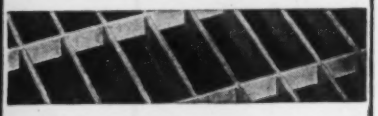

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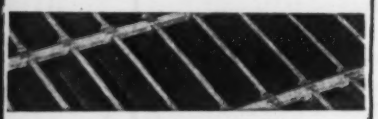

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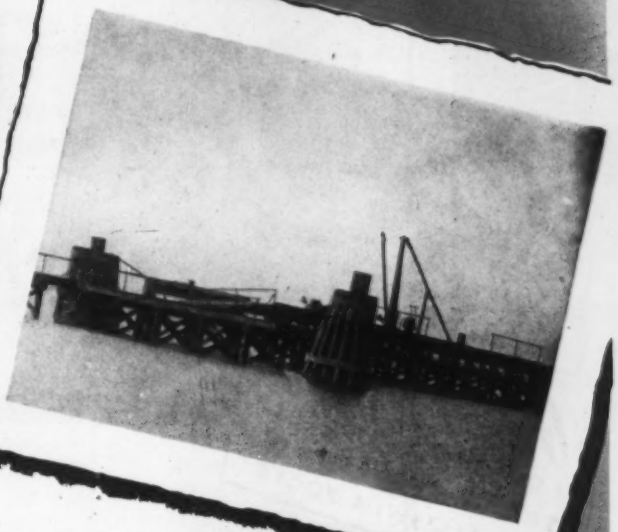

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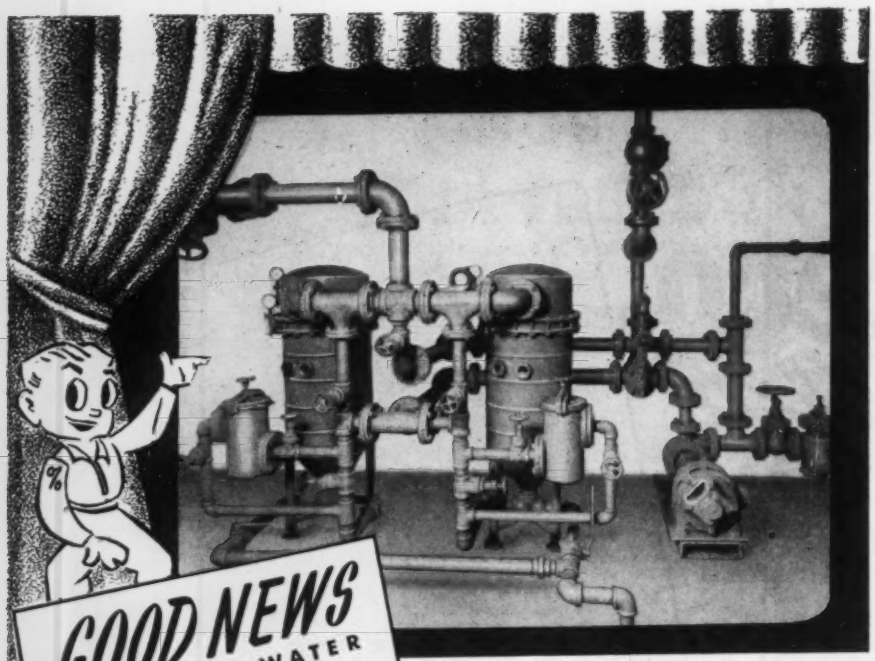

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CHOCOLE, JOSEPH FRANK, Assoc. M., Erection Engr., Chicago Bridge & Iron Co., 1305 West 105th St. (Res., 10213 South Racine Ave.), Chicago 43, Ill., readmitted Nov. 18, 1946.

DENHAM, GLENN ADAM, Assoc. M., Asst. City Engr., City of Little Rock, Ark., City Hall (Res., 6118 Kenwood Road), Little Rock, Ark., readmitted Nov. 18, 1946.

DOERR, DALE DELMAR, Jun. Asst. Engr., Armour Research Foundation, 35 West 33d St. (Res., 4910 South Blackstone Ave.), Chicago, Ill., reinstated Dec. 19, 1946.

EDDECOMBE, ARTHUR RALPH BROOKS, Assoc. M., Lt. Col., I.E.; The Sycamores, West Allington, Bridgeport, Dorset, England, reinstated Jan. 6, 1947.

FONTAINE, ELMER BERNARD, M., Vice-Pres., Wunderlich Cont. Co., Gen Contrs., P.O. Box 1269, Kingman, Ariz., reinstated Jan. 2, 1947.

GILLETTE, PAUL CLIFFORD, M., Comdr., CEC, U.S.N.R., 6106 North 22d St., Arlington, Va., reinstated Dec. 27, 1946.

GROW, VIRGIL BYRON, JR., Assoc. M., P.O. Box 118, Roanoke, Va., reinstated Dec. 26, 1946.

IVANCHENKO, ANDREI IVANOVICH, M., Civ. Engr., Associate Prof., Hydraulics and Water Power, Industrial Inst. (Res., 3 Engels St.), Novocherkassk, Union of Socialist Soviet Republics, reinstated Dec. 3, 1946.

JOHNS, JOSEPH THOMAS, JR., Jun., 1716 Capitol Ave., Apt. E, Sacramento, Calif., reinstated Dec. 30, 1946.

JORGENSEN, ROY ERNST, M., Director of Highway Planning, State Highway Dept., 165 Capitol Ave., Hartford (Res., Overlook Rd., Glastonbury), Conn., readmitted Oct. 21, 1946.

KELLY, JOHN JOSEPH, Assoc. M., Asst. Engr., Board of Transportation, City of New York, 250 Hudson St. (Res., 309 East 200th St.), New York 58, N.Y., reinstated Jan. 1, 1946.

KETCHUM, DANIEL READING, Assoc. M., Engr., U.S. Engrs., 604 Santa Fe Bldg., Galveston, Tex., readmitted Nov. 18, 1946.

KNEALE, JOHN STEPHEN, JR., Jun., Estimator (San. Engr.), The Permutit Co., 517 Hamilton National Bank Bldg., Chattanooga 2, Tenn., reinstated Dec. 11, 1946.

LANDSEM, PETER THRONAES, Assoc. M., Chf., Tech. Div., Bureau of Reconstruction, Norwegian Dept. of Supply and Reconstruction (Res., Care, Dr. J. E. Myer, 4855 Reservoir St., N.W., Washington, D.C.), reinstated Jan. 1, 1947.

MCCORMICK, FRANK JAMES, Assoc. M., Associate Prof. of Applied Mechanics, Kansas State College, Manhattan, Kans., readmitted Nov. 18, 1946.

MILLARD, CHARLES FREDERICK, Jun., 3315 Batavia Ave., Baltimore 14, Md., reinstated Dec. 9, 1946.

MORGENTHALER, FREDERICK LEONARD, JR., M., Constr. Engr. and Estimator, H. B. Alexander & Son, Inc., 3d and Vaughn Sts. (Res., 2714 North 2d St.), Harrisburg, Pa., readmitted Dec. 16, 1946.

RICE, GEORGE PETER, M., Cons. Engr., Audubon Bldg., New Orleans, La., reinstated Dec. 27, 1946.

SANTI, MARK GIOVACCHINO, Assoc. M., 43 Park Ave., Portchester, N.Y., reinstated Dec. 2, 1946.

SMALL, JOSEPH WARDER, JR., M., Asst. to Chf. Engr., American Bridge Co., Room 1502, Frick Bldg., Pittsburgh 19, Pa., readmitted Dec. 16, 1946.

VAN DEUSEN, ALDEN JOHNSON, Jun., 4133 West 103d St., Inglewood, Calif., reinstated Dec. 9, 1946.

WALLACE, GALEN ANSON, M., Head Engr., Corps of Engrs., War Dept., Washington, D.C., readmitted Nov. 18, 1946.

WEED, SAM ALLEN, Assoc. M., 5961 Buena Vista Ave., Oakland 11, Calif., readmitted Nov. 18, 1946.

WU, KING CHING, Assoc. M., House No. 1, Lane 819 Rue Ratard (Ku Lu Road), Shanghai, China, reinstated Dec. 19, 1946.

XAVIER, JULIO FRANCIS, JR., Assoc. M., Engr. (Hydr.) P-1, New England Div., U.S. Engr. Dept., Park Square Bldg., Boston, Mass. (Res., 615 Wood St., Bristol, R.I.), readmitted Dec. 16, 1946.

Resignations

ALLEN, LEONARD BARNES, M., P.O. Box 6119 Cleveland 1, Ohio, resigned Dec. 31, 1946.

BAMPTON, NORMAN, Jun., 13 Florence St. Ext. East Hartford, Conn., resigned Jan. 2, 1947.

BARBEAU, LIONEL MARCEL, Jun., Prin. Eng. Aide U.S. Army Engrs., 700 Guardian Bldg., Detroit (Res., 1528 Swansea St., Willow Run), Mich., resigned Dec. 28, 1946.

BENDEL, ROLAND, Assoc. M., Asst. Engr., Alameda County Mosquito Abatement Dist., Box 161, Decoto, Calif., resigned Dec. 26, 1946.

BOGARDUS, ROBERT KENT, Jun., 537 Fifty-third St., Brooklyn 20, N.Y., resigned Dec. 6, 1946.

BONDURANT, JOHN PARNELL, Assoc. M., Athens Lumber Co., Box 192, Athens, Ga., resigned Dec. 12, 1946.

BONUCCHI, VICTOR PAUL, Jun., 2721 Sixth St., Peru Ill., resigned Dec. 31, 1946.

BOUCHER, FRANCIS LEROY, Jun., Millington, N.J., resigned Jan 2, 1947.

BOYD, ALFRED, M., Middlebrook, Mo., resigned Dec. 17, 1946.

BROWN, GEORGE PARKS, Assoc. M., Res Engr., State Highway Dept., Box 1082, Del Rio, Tex., resigned Dec. 27, 1946.

BROWN, HOYT CUTHBERT, Assoc. M., 133 Hines Terrace, Macon, Ga., resigned Dec. 31, 1946.

CARD, FRANCIS CHARLES, Jun., Cliffdale Drive Donelson, Tenn., resigned Dec. 31, 1946.

DADING, CHARLES HENRY, M., Constr., Engr., U.S. Maritime Comm., 1015 Chestnut St., Room 1024 (Res., 6733 Rutland St.), Philadelphia, Pa., resigned Dec. 27, 1946.

DEBORD, MARIANNA SCHROEDER (MRS.), Jun., with Plastics Planning Dept., Dow Chemical Co. (Res., 1606 Montrose St.), Midland, Mich., resigned Dec. 12, 1946.

FARGHER, THOMAS EDWIN NELSON, Assoc. M., "Rosmerrin," Feock, Truro, Cornwall, England, resigned Dec. 4, 1946.

FREMON, JOHN LEON, Jun., Manager, State Equipment Co., 642 Market St., Kingston, Pa., resigned Dec. 31, 1946.

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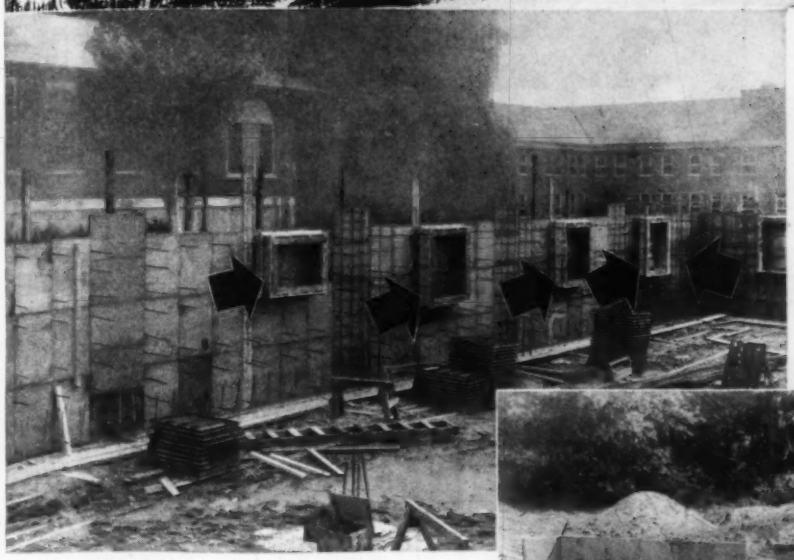

AT LEFT—Arrows indicate reinforcing steel in place . . . Window bucks, box-outs, etc. are nailed directly to the plywood face of the UNI-FORMS. Note how one side of the form is completely erected and how easily attachments and reinforcing steel, etc. can be placed. THIS MEANS IMPORTANT TIME AND COST SAVINGS.

RIGHT—UNI-FORM Panels are erected to form one side of this residential foundation. Window bucks, box-outs can be readily nailed to the forms, and the other side of the form erected. UNI-FORM Ties visible here, lock the panels into a rigid, accurately spaced form which requires alignment on one side only.

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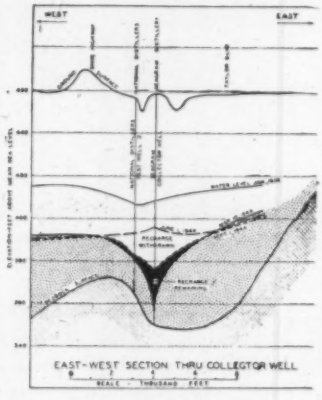

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FRINK, JOHN WESTLAKE, Jun., Care, Geology Div., Bureau of Reclamation, 301 Bank of America Bldg. (Res., 819 Pershing St.), Visalia, Calif., resigned Dec. 28, 1946.

GERMAN, ROBERT MONROE, Jun., Vice-Pres., Fox Eng. Co., 1336 Francis St. (Res., 204 West Mason St.), Jackson, Mich., resigned Dec. 20, 1946.

GRAY, EDWARD ZIGMUND, Jun., Structural Engr., Boeing Aircraft Co. (Res., 2720 South West 151st St.), Seattle 66, Wash., resigned Dec. 5, 1946.

GREENHALGH, SIDNEY FRANKLYN, Assoc. M., 437 Maple Ave., Rahway, N.J., resigned Dec. 30, 1946.

HARDEN, MILTON JONES, M., Granby, Mo., resigned Dec. 6, 1946.

HARDING, ROBERT NELSON, Jun., Box 608, Hattiesburg, Miss., resigned Dec. 28, 1946.

HAUSSLER, ROBERT WALTER, Jun., Mech. Engr., Navy Research Dept., California Inst. of Technology, 1201 East California, Pasadena (Res., 4783 North Huntington Drive, Los Angeles 32), Calif., resigned Dec. 27, 1946.

HORTON, RALPH MCKINLEY, JR., Jun., 2732 Blossom St., Columbia 52, S.C., resigned Dec. 31, 1946.

KILLAM, PAUL DICKSON, Jun., 15 Minerva St., Swampscott, Mass., resigned Dec. 31, 1946.

KITCHEN, JOHN EVANS, Assoc. M., P.O. Box 1831, Reno, Nev., resigned Dec. 30, 1946.

KRASNODEBSKI, CASIMIR PAUL, Jun., 57a Seventy-fourth St., Brooklyn 9, N.Y., resigned Dec. 20, 1946.

LUCK, DAVIS ROYALL, Jun., 574 Loveman Ave., Worthington, Ohio, resigned Jan 2, 1947.

MATHEWS, JAMES THOMAS, M., Rear Admiral, CEC, U.S.N., 1036 New Federal Bldg., Eighth Naval Dist., New Orleans, La., resigned Dec. 17, 1946.

MCMAHAN, LEONARD CLYDE, JR., Jun., Senior Supervisor, Boeing Aircraft Co., Renton (Res., 11014 Auburn Ave., Seattle 88), Wash., resigned Dec. 31, 1946.

MILLS, ARTHUR WILBUR, Jun., Associate Engr., U.S. Engr. Dept., 541 Federal Bldg. (Res., 3121 Bob-O-Link, Rd.), Louisville 4, Ky., resigned Dec. 28, 1946.

PEIRCE, JAMES BUTLER, Jun., Cpl., U.S.M.C.R.; Witch Hill, Topsfield, Mass., resigned Dec 12, 1946.

PETERSEN, WARREN OTTO, Jun., 1083 Wendell Ave., Schenectady, N.Y., resigned Dec. 31, 1946.

REILEY, RALPH LEONARD, Jun., The A. W. Johnson Co., 218 E. Broad St., Texarkana, Ark., resigned Dec. 31, 1946.

SANDERSON, JOHN CHRISTOPHER, M., (Retired), (Sargent & Lundy), 140 South Dearborn St., Chicago, Ill., resigned Dec. 27, 1946.

SHONE, DOUGLAS JOHN, Jun., Care, H. Justice Williams, 1924 Delancey Pl., Philadelphia 3, Pa., resigned Dec. 31, 1946.

SIMMONS, JOHN LELAND, Assoc. M., Lt., CEC, U.S.N.R.; 206 West 2d Ave., Cheyenne, Wyo., resigned Dec. 17, 1946.

SOHRN, HENRY MARTIN, Jun., 115 East Country Club Drive, Phoenix, Ariz., resigned Dec. 31, 1946.

SPAHR, CHARLES EUGENE, Jun., 1850 Forest Hills Blvd., Cleveland 12, Ohio, resigned Dec. 12, 1946.

SULLINS, ROBERT TIMOTHY, JR., Jun., Stress Analyst, Consolidated Vultee Aircraft Corp. (Res., 1008 University Drive, Apt. 138), Fort Worth, Tex., resigned Dec. 28, 1946.

TAMMINGA, SAMUEL WILLIAM, Jun., 707 Hoyt St., South East, Grand Rapids 7, Mich., resigned Dec. 31, 1946.

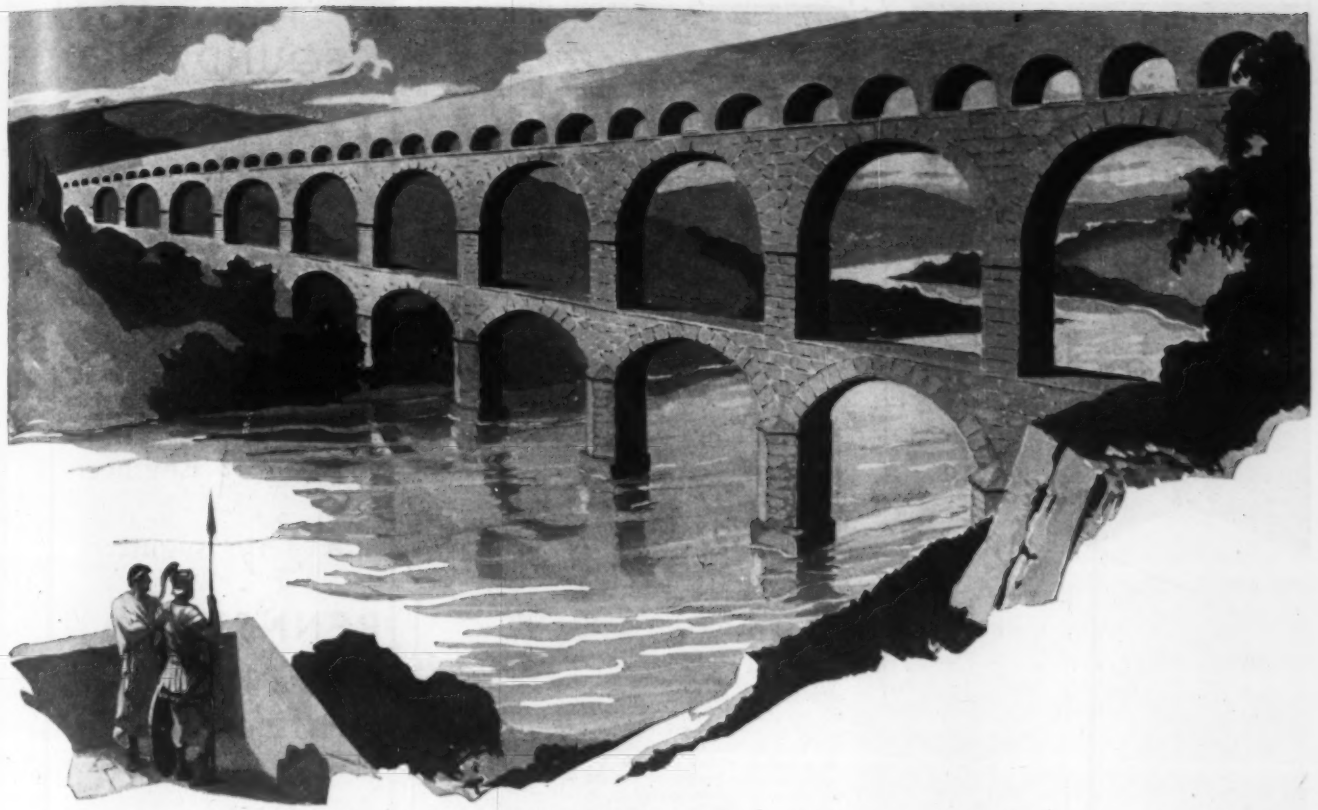
WATTS, ALBERT FRASER, Jun., Constr. Engr., A. S. Wikstrom, P.O. Box 217, Skaneateles (Res., Care, Burdicks Trailer Park, North Syracuse), N.Y., resigned Dec. 27, 1946.

WELLS, WILLIAM GORDON, Assoc. M., Care, Williams, Coile & Pipino, 403 Nelson Bldg., Newport News, Va., resigned Dec. 12, 1946.

WILL, CURT HESSE, Assoc. M., 1805 Maryfield Drive, Ann Arbor, Mich., resigned Dec. 12, 1946.

ZELNER, OTTO SAMUEL, M., Associate Prof Surveying, Univ. of Minnesota, Main Eng. Bldg., Minneapolis, Minn., resigned Dec. 27, 1946.

[*Correction:* In the December issue, the addresses of Shu-t'ien Li and Tung Yen Lin, appearing under "Reinstatements," were transposed. Mr. Li is dean of engineering, National Pei-Yang University, Tientsin, China; Mr. Lin is assistant professor of civil engineering at the University of California, Berkeley, Calif.]



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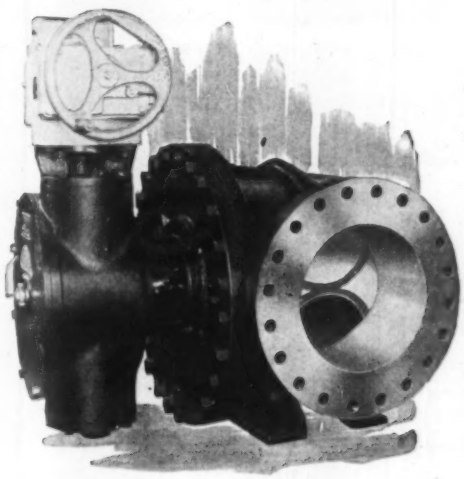

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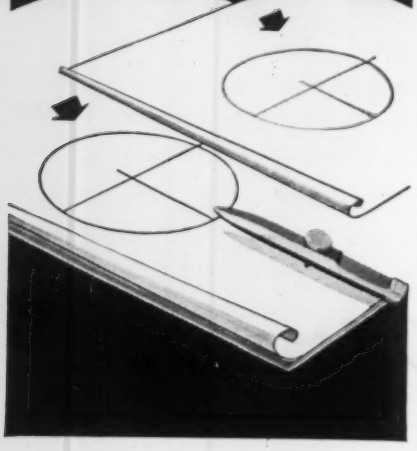

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HEATING AND AIR CONDITIONING, 6 ed. By J. R. Allen, J. H. Walker, and J. W. James. McGraw-Hill Book Co., New York and London, 1946. 667 pp., illus., diagrs., charts, tables, 9¼×6 in., cloth, $5. The new edition of this standard text has been revised as needed to bring it up to date. In addition to the revision of existing material, a new section on panel heating is included, and the principle of a reversed-cycle refrigeration system has been treated from a theoretical and practical viewpoint. A feature of the book is a detailed discussion of the design of an actual air-conditioning system. The book is suitable both for the engineering student and for home study.

HISTORY OF THE BRITISH RAILWAYS DURING THE WAR, 1939–1945. By R. Bell, with a foreword by Sir W. V. Wood. Railway Gazette, London, 1946. 291 pp., diagrs., maps, tables, 9×6 in., cloth, 25s. This book describes the accomplishments of the British railways in meeting the requirements of troop and material transport, of evacuation problems, and of operation and maintenance with reduced staffs and supplies. Considerable statistical information is included. A wide range of topics is covered, with chapters on docks and harbors, rates and charges, air-raid precautions, and the effects of aerial warfare, in addition to the general traffic and engineering problems.

HUMAN FACTORS IN AIR TRANSPORT DESIGN. By R. A. McFarland. McGraw-Hill Book Co., New York and London, 1946. 670 pp., illus., diagrs., charts, tables, 9¼×6 in., cloth, $6. A comprehensive treatment of a subject of increasing interest, this new book analyzes those factors in the design of air transport planes which influence the human organization in flight. It represents a compilation and interpretation of biological date which can be used to improve the efficiency of air crews and the safety and comfort of air travelers. The implications of theoretical material have been developed, and the application to industry and the needs of engineers are brought out. Special topics such as the control of insects and air-borne diseases are also given consideration.

MATHEMATICAL AIDS FOR ENGINEERS. By R. W. Dull. McGraw-Hill Book Co., New York and London, 1946. 346 pp., diagrs., charts, tables, 8½×5¼ in., cloth, $4.50. This book gives engineers many basic mathematical tools essential for dealing with the higher mathematics involved in today's engineering developments. In addition to various chapters dealing with particular mathematical operations, there are chapters on the types of motion involved—rotation, linear and harmonic motion, etc. The book is intended both for study and reference, and supplements the author's larger work, *Mathematics for Engineers*.

TRIGONOMETRY REFRESHER FOR TECHNICAL MEN. By A. A. Klaf. McGraw-Hill Book Co., New York, 1946. 629 pp., diagrs., charts, tables, 8½ × 5¼ in., cloth, $5. Plane and spherical trigonometry are presented for the use of the man who wants to apply them to various technological fields. Features of this comprehensive treatment include a simplification of the principal functions of an angle, a progressive development of logarithms, and an extensive chapter on the theory, construction, and use of the straight slide rule. Problems in mechanics, surveying, electricity, aerial and sea navigation, light, physics, and hydraulics are presented and solved in the book.

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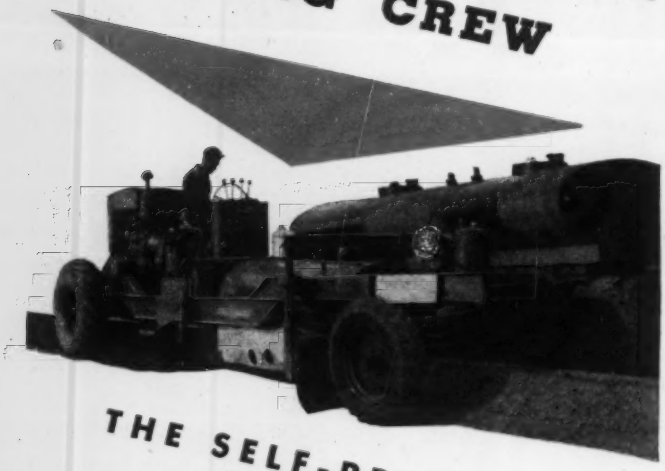

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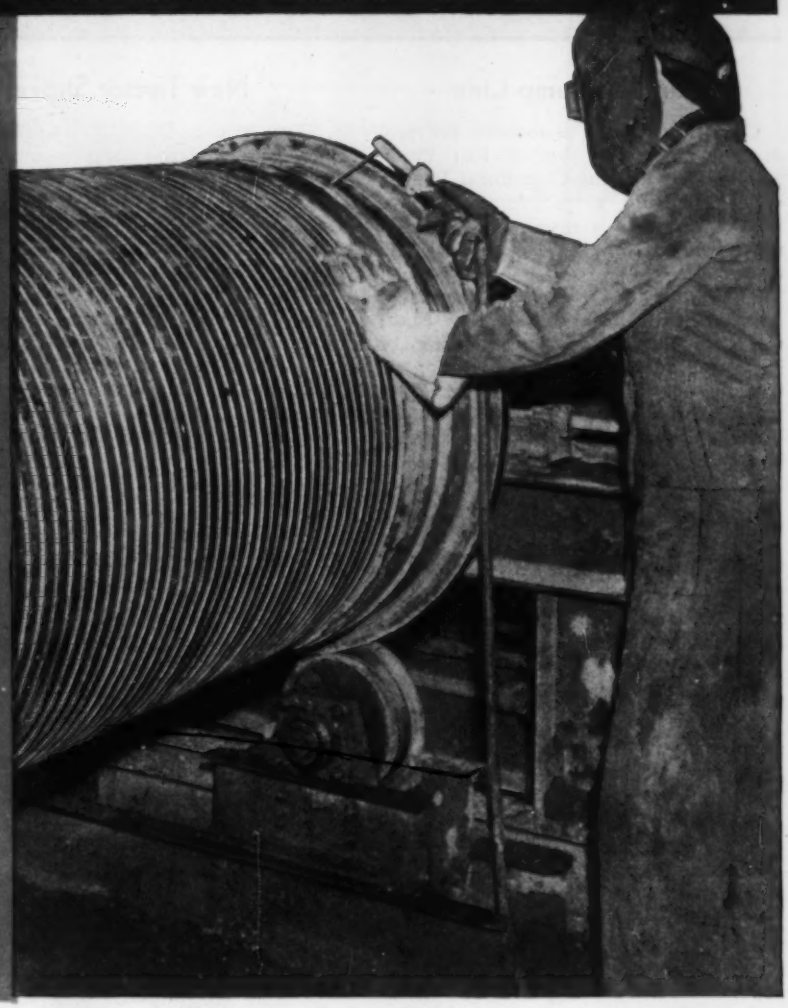

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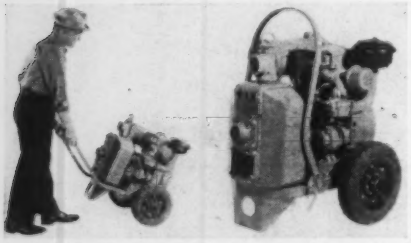

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All Airco wires and tapes have been subjected to extensive laboratory tests as well as practical "on the job" examinations. They are manufactured in several diameters and are designed to meet the general requirements of high-speed production welding. These automatic wires may be used separately or in conjunction with the tapes depending upon the job to be performed. Further information from Air Reduction, 60 East 42d Street, New York 17, N.Y., or to any local AIRCO office.

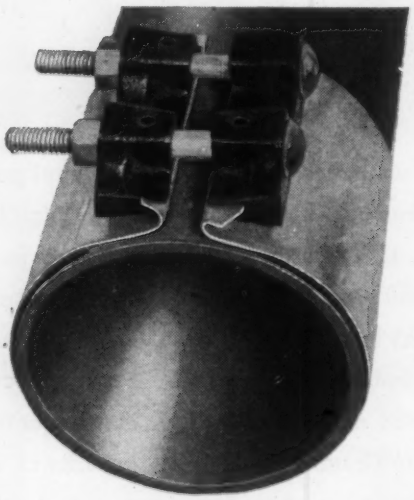
New Tractor Shovel

THE MODEL TS-5 "Tracto-Shovel," a new tractor shovel for use on the Allis-Chalmers HD-5 long track, rigid truck frame Diesel tractor, is the first in a line of tractor equipment that will be built by the Tractomotive Corp., Findlay, Ohio.

The "Tracto-Shovel" has a hydraulically controlled bucket operated by double-acting lift and dumping cylinders. These cylinders are designed to provide adequate down pressure and controlled dumping and closing of the bucket. The bucket can be dumped or closed at any height, quickly or slowly, and has an automatic tilt-back to prevent spillage. Tractor-width buckets of one cu. yd. capacity are standard equipment, with bulldozer blades or special buckets optional. The shovel frames are mounted directly to the tractor and contain a 25-gal. capacity oil reservoir.

Overall length of the "Tracto-Shovel" is 14 ft., 6 in., the width is 6 ft., $3\frac{1}{2}$ in., and the height, with the bucket down, is 5 ft. $11\frac{5}{8}$ in.

Pipe Leak Repair Clamp

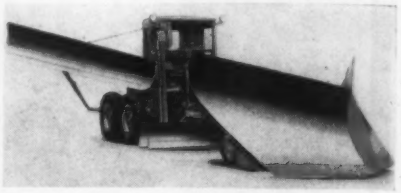


A NEW PIPE leak repair clamp has been introduced by Smith-Blair, Inc., of South San Francisco, Calif. According to the manufacturer, this clamp is adapted for all types of metallic pipe and for asbestos-cement pipe. The clamp has a copper band sleeve which gives about 100% wrap-around without using a tongue. The cast clamping lugs can be reduced in length from 30 in. to 3 in., even multiples of 3 in., in the field without special tools. Clamp sizes now produced are for pipe from $\frac{1}{2}$ to 30 in. in diameter.

Snow Removal Equipment

NEW AND IMPROVED SNOW removal attachments are now available for the "Caterpillar" Diesel No. 212 Motor Grader as well as the two larger sizes of motor graders manufactured by Caterpillar Tractor Co., Peoria, Ill. For shipment with motor graders tabbed for future delivery as well as for their graders already in operation in the field, "Caterpillar" is producing such needed attachments as the V-type snow plow, mast-type snow wing and reversible one-way plow and bulldozer.

The snow wing and bulldozer are new to the "Caterpillar" Diesel No. 212 Motor



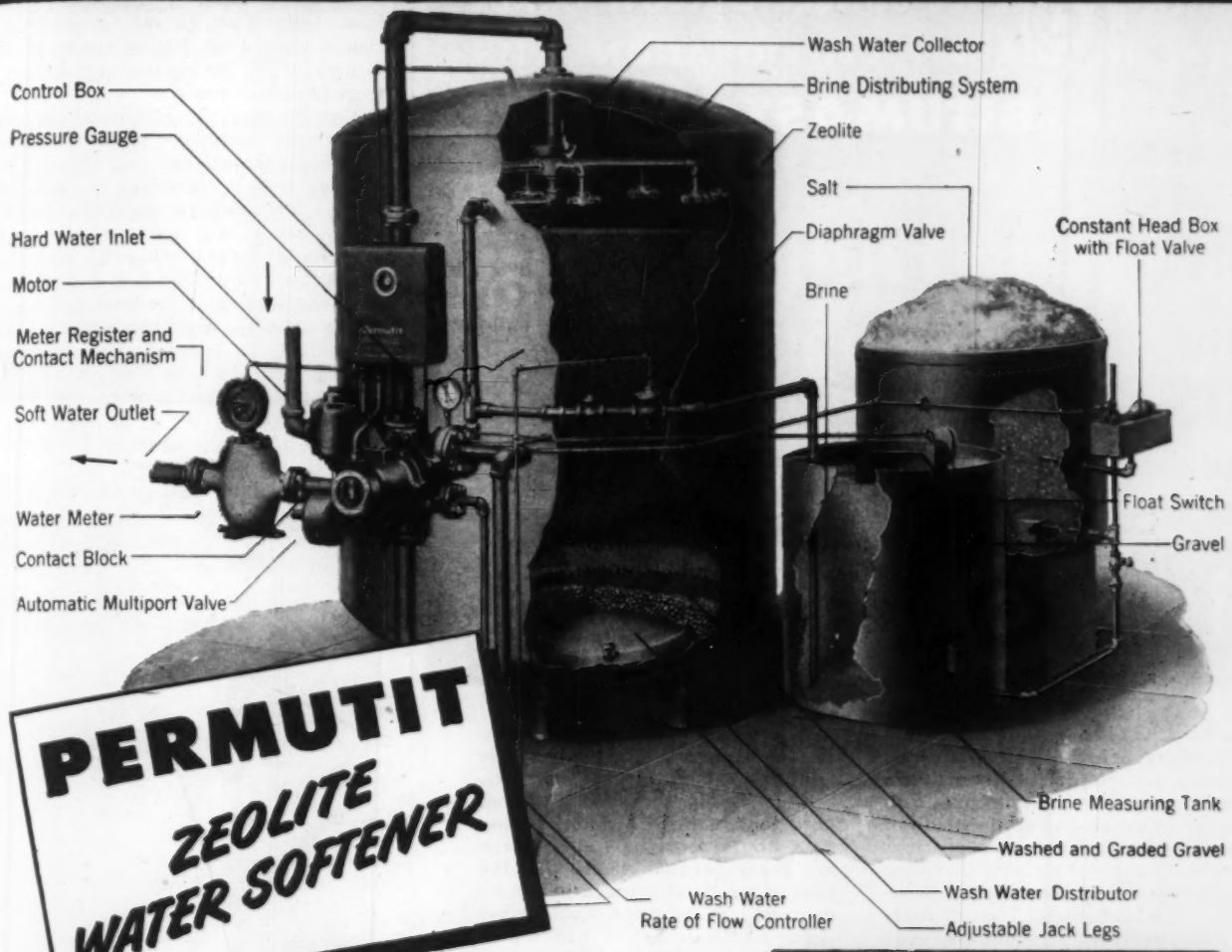
Grader, giving that machine the same year-around utility which has marked the "Caterpillar" Diesel No. 12 and No. 112 motor graders in the past. Marked improvement in the operation of the mast-type snow wing has been effected in all sizes with modifications which insure smooth parallel lift with both ends of the blade elevated simultaneously. The mast-type snow wing for the smallest grader has a 10 ft. blade, 27 in. high with a weight of 1500 lbs. The reversible one-way plow and bulldozer for the "Caterpillar" Diesel No. 212 Motor Grader is 8 ft., 6 in. wide and 28 in. high, weighs 1,740 lbs. and has a lift of 12 in.

Motors

THE ALLIS-CHALMERS MFG. CO., Milwaukee, Wis., has announced that it is producing a complete line of outdoor weatherproof, totally enclosed motors in the larger sizes ranging up to and above 2,000 hp.

Principal change in the new line of motors in the larger ratings is a complete redesign of the ventilation heat-transfer system. All air passages are practically self cleaning and pockets in which water or liquid might be trapped have been eliminated. Air passage tubes can be easily cleaned with a brush or an air or water hose. The new totally enclosed all-fabricated steel motor is expected to find particular application in central station power plant service in connection with draft fans and in the chemical industry. Here, because of its water-proof joints and new cooling system, it promises to be as effective as cast-iron motors.

Completely Automatic-



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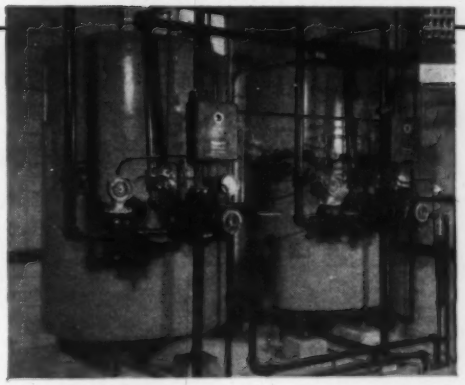
Our staff will be glad to work with you and your consultants in selecting the best type of water treatment for your community. Write The Permutit Company, Dept. CE2, 330 West 42nd Street, New York 18, N. Y., or Permutit Co. of Canada, Ltd., Montreal.

*Trademark Reg. U. S. Pat. Off.



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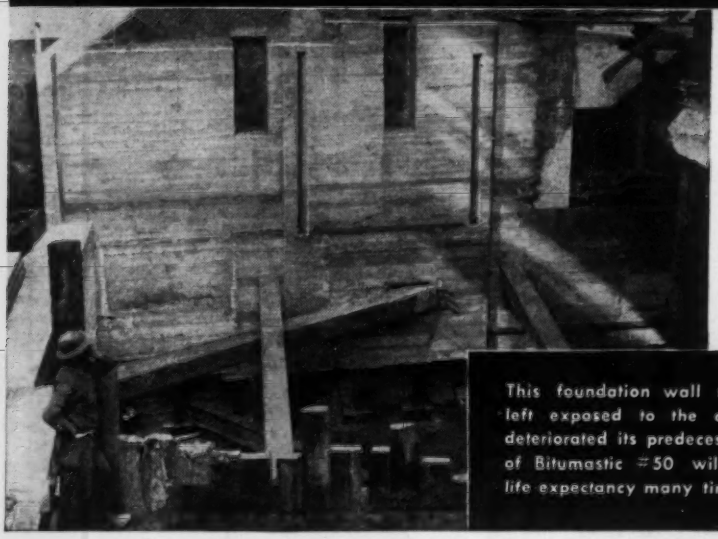

This foundation wall should not be left exposed to the conditions that deteriorated its predecessor. A coating of Bitumastic #50 will increase its life expectancy many times.

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Power Take-Offs

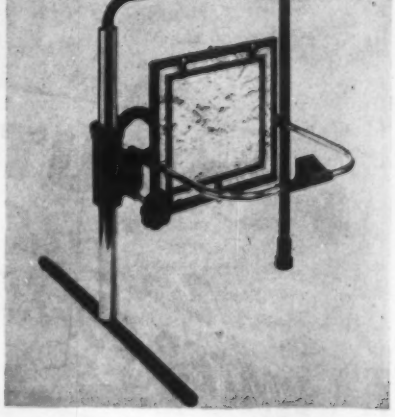
LARGE SCALE PRODUCTION will begin in 1947 on eight standard models of Davey Heavy Duty Power Take-offs, the Davey Compressor Co., Kent, Ohio, announced recently. The Davey Power Take-off uses an internal and external gear drive, operating as a strong and durable spline. Installation is made to the rear of the truck transmission case. The power take-off then becomes an integral part of the drive shaft assembly for transmitting power direct from the truck engine either through V belts or chain drive. The eight power take-offs are available in three separate capacities, 50, 75, and 100 hp.

The Model 50 take-off is manufactured in both single and simultaneous drive designs. The latter permits operation of truck, or individual operation of driven equipment, or of both simultaneously. Models 75 and 100 are manufactured for single drive, simultaneous drive, and also for double drive. With double drive take-offs, the truck may be operated alone; either of two pieces of driven equipment may be operated individually, or both pieces of driven equipment may operate simultaneously. Equipment now being driven by heavy duty power take-offs includes truck-mounted air compressors, generators, gas well bailers, concrete mixers, fire-fighting equipment, welders, machine shops, pumps, street sprinklers, home insulation blowers, rock crushers, etc.

A New Mapping Instrument

THE FAIRCHILD CAMERA and Instrument Corp., Jamaica, N.Y., has announced the development of a new mapping instrument, the Rectoplanigraph, to provide the map-maker with a simple means of rectifying and transferring planimetric detail from aerial photographs to maps and charts. Based on the principle of the camera lucida, the Rectoplanigraph is extremely easy to use.

The Rectoplanigraph is a portable, lightweight instrument easily assembled and disassembled, and can be set on a drafting table. Its design provides indexed adjustments for three focal lengths (6, 8 1/4 and 12 in.), a micrometer adjustment for all variations in scale, and other adjustments for rectification of the photographs to compensate for errors introduced by tip and tilt. A picture-holder is fitted with masks to accommodate air-photos ranging from 4×5 to 9×9 in. A high quality prism, assures a sharp, well-illuminated image.



In using the Rectoplanigraph, the map-maker views a vertical or oblique aerial photograph, mounted in the picture-holder, through a peep-sight attached to an eyepiece arbor. He aligns the ground control on the photograph with corresponding control on the chart lying before him under the eyepiece, by making adjustments for the focal length of the camera used in taking the aerial photographs, and by using the micrometer adjustment to bring the image to proper scale. He refers to the fiducial marks on the photograph for lining up the photograph with the optical system. He finally makes an additional adjustment to rectify for tip and tilt. Usually only minor adjustments are necessary to agree with ground conditions. When all adjustments have been made, he traces the desired supplementary detail on the map or chart by following the image of lines from the photo. The Fairchild Rectoplanigraph, a companion piece to more elaborate stereoscopic mapping instruments, enables the map-maker to fill in secondary details quickly after the major control points have been established.

Improved Lincolnweld Head

IMPROVEMENTS OF ITS welding head designed to simplify production installation setups and increase speed of operation, are announced for its "Lincolnweld" hidden-arc process of automatic metallic shielded arc welding by The Lincoln Electric Company, Cleveland, Ohio. The new, improved head is designated as the "LAF-2." To expand its use on sheet metal work, the "LAF-2" has been designed to accommodate $^{3}/_{32}$-in. electrode. The head is shipped with the same lower wire contact jaws as the previous head designated as "LAF-1" which accommodates electrode wire ranging from $^{1}/_{8}$ in. to $^{4}/_{32}$ in., but an extra movable tapered contact jaw is supplied which can be interchanged for $^{3}/_{32}$-in. wire.

The controls of the "LAF-2" have been modified to simplify arc starting. Now all that is required to start the arc is to turn a single control switch to the "Down Weld" position. This causes the electrode to feed down until the end touches the work piece. Short-circuiting the wire to the plate automatically causes the wire feed motor to stop. The flux valve is then turned on and the arc started by means of a push button. The arc is extinguished and the electrode is withdrawn by moving the operating switch from "Down Weld" to the "Up" position. Another innovation is the use of plugs and receptacles which simplify and reduce installation time for the "LAF-2" head. Two receptacles are mounted in the automatic control box and plugs are attached to one end of the cable coming from the welder supply and one end of the cable coming from the head itself.

The "Lincolnweld" process is designed for use with direct current, utilizing a bare metallic electrode which is fed through a granular flux deposited on the joint to be welded. Sufficient flux is applied to completely cover the arc and the molten metal; the unfused flux is then reclaimed. It has been successfully used in welding all types of joints.

New Force-Feed Loader

ATHEY PRODUCTS CORP., 5631 W. 65th St., Chicago, Ill., announces the new Model 3 Athey Force-Feed Loader which is highlighted by "Finger-Tip" hydraulic control and many new features of design. The new unit is used on such jobs as road widening and resurfacing, ditch building and cleaning, dressing slopes, loading oil mix, etc., and works as a companion tool for the "Caterpillar" Motor Grader.

With "Finger-Tip" hydraulic control, the new Model 3 provides four levers for raising and lowering feeder, moldboard, throat and conveyor. This loader also has roomy operator's platform, new conveyor and throat design, positive belt alignment, more accessibility, and greater loading efficiency. The new machine will be sold through Athey—"Caterpillar" distributors.

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Literature Available

CONDITIONING OF WATER—Advanced and modern methods and apparatus for conditioning water and other liquids are described in a 60-page bulletin published by Liquid Conditioning Corp., manufacturers of Liquon equipment and Liquonex materials for water softening and clarification. The bulletin describes the many different types of water conditioning processes and explains the applications, advantages, and limitations of each type. Included in the material specially developed for the bulletin are tables listing the various kinds of gaseous and solid impurities, showing the effects, limits of tolerance for various purposes, methods of removal and residual amount of each impurity after treatment; and also a comparison chart showing the chemical results produced by various water treatment methods. Ask for Bulletin G. from Liquid Conditioning Corp., 423 W. 126th St., New York 27, N.Y.

EARTHMOVERS—Recently prepared by R. G. LeTourneau, Inc., Peoria, Ill., is a new 12-page folder, Form No. TP-126, covering a wide range of Tournapull applications. Projects covered range from general earthmoving, construction, mines, pits, quarries, and railroads to applications in industrial, agricultural, and oil fields.

PIPE—"Pipe in American Life," a 48-page illustrated booklet published by the Committee on Steel Pipe Research of the American Iron and Steel Institute, presents the historical background and modern uses of metal pipe, with emphasis on the use of steel pipe. Chapters are devoted to the uses of steel pipe in homes, large buildings, process industries, railroads, shipping, mining, water supply systems, the oil industry, the gas industry, refrigeration, irrigation and on farms. Single copies are available from the American Iron and Steel Institute, 350 Fifth Ave., New York 1, N.Y.

SKULLGARDS—The complete line of M.S.A. Skullgards for protection against all head hazards encountered in industry is described and illustrated in a colorful new Bulletin, No. DK-13, published by Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh 8, Pa. M.S.A. Skullgards are made in a wide variety of shapes and styles to suit the special needs of men in construction work, oil fields, chemical plants, steel mills, mines, pit and quarry operations, and all other industrial activities where head-injury hazards exist.

WELDING AND CUTTING—The Air Reduction Sales Co. has announced publication of a new 64-page general welding and cutting products catalog. Profusely illustrated, this catalog is divided into two sections: one for oxyacetylene welding and cutting gases, equipment, and supplies; the other for arc welding machines, accessories, and electrodes. The last ten pages of the catalog are devoted to specially compiled electrode price lists. Write to Air Reduction Sales Co., 60 E. 42nd St., New York 17, N.Y.

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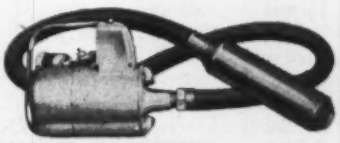

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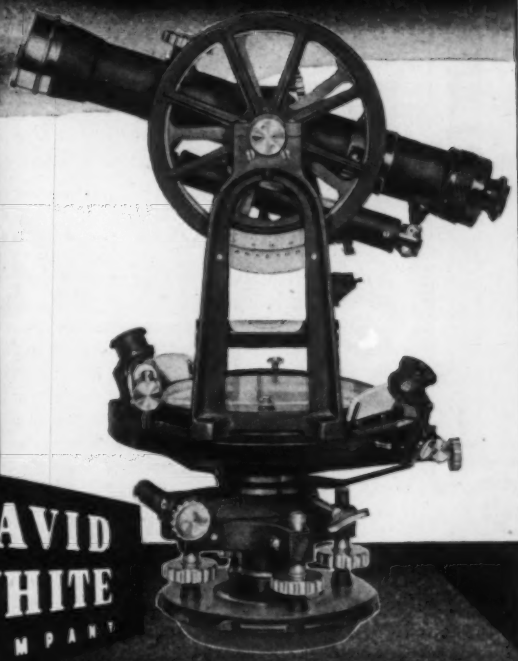

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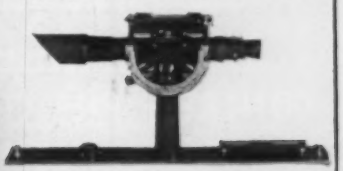

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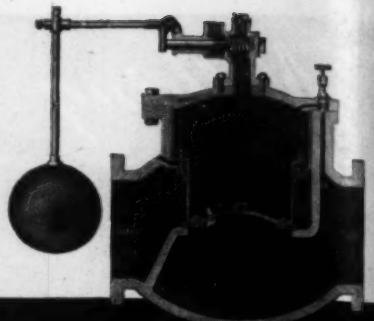
SNOW REMOVAL—The attachments which convert motor graders, masters of earthmoving, into snow removal units are highlighted in Low Cost Snow Removal, a new folder released by Caterpillar Tractor Co., Peoria 8, Ill. The illustrated color folder focuses attention on the "Caterpillar" V-type snow plow, mast-type snow wing and reversible one-way plow and bulldozer again in production for exclusive use with the "Caterpillar" Diesel No. 12 and No. 112 motor graders and manufactured for the first time, in proportionate size, for the "Caterpillar" Diesel No. 212 Motor Grader. Basic specifications are given and principal features of the attachments are treated editorially and pictorially.

STANDARD CLAY PIPE & FITTINGS—Cooperating with the U.S. Bureau of Standards, clay pipe manufacturers now classify their products according to a uniform schedule of standard and special items. The Clay Sewer Pipe Association, Columbus, Ohio, has issued a catalog giving complete dimensional descriptions of the standard pipes and fittings manufactured by its members. 16 pages—8½ by 11 inches.

VAPORSPHERE—The Chicago Bridge & Iron Company, 332, S. Michigan Ave., Chicago 4, Ill., announces the publication of a new 20-page booklet, "The Vaporsphere." It describes the method of reducing evaporation losses from flat-bottom tanks storing volatile liquids by installing a vapor-saving system with facilities for the temporary storage of vapor. The method for determining the correct size of the Vaporsphere, which is used for the temporary storage of the vapor, is discussed, together with the method of designing the vapor lines which connect the flat-bottom tanks to the Vaporsphere. The vapor pressure, expansion of air-vapor mixture, and the flow of vapor in the lines can be read directly from charts included in the booklet.

WATER COLLECTORS—A very thorough and attractive new booklet tells the complete story of the Ranney System of Water Production for industrial and municipal use. It describes the Ranney method and collectors, covering their installation or construction, and gives typical performance records. Ranney Method Water Supplies, Inc., 507 Majestic Bldg., 63 South High St., Columbus, Ohio.

WIRE, ROD, AND STRIP—"Choosing wire, strip, or rod of uniform dimensions for difficult high-temperature or corrosive applications is made easier by reference to the engineering data and illustrations in a new catalog offered by the Alloy Metal Wire Co., Inc., Prospect Park, Pa. The catalog sections include engineering information on strength, electrical resistivity, modulus of elasticity, heat treatment, temperature limits, and magnetic properties. The metals covered are the high nickel content alloys and specialized Monels.



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